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The Construction of a Price Index for the South African Medical Scheme Industry

Dissertation submitted in partial fulfilment of the
requirements for the degree of Master of Business
Science

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Declaration

I hereby declare that:

- i. this is my own unaided work, both in conception and execution, and that apart from the normal guidance of my supervisor, I have received no assistance apart from that stated below;
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S Ramjee

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Abstract

A methodology is proposed for constructing a price index that reflects the change in the prices of the goods and services purchased by medical schemes in South Africa. The methodological choices were made taking cognisance of the unique characteristics of the South African medical scheme environment, both in terms of the factors influencing the mix of goods and services purchased by medical schemes, as well as the factors affecting price determination.

An example of a pharmaceutical price index was constructed to illustrate the proposed methodology, the results of which are presented.

Whilst the proposed methodology provides a base for creating a meaningful and useful medical scheme price index there is considerable further work that needs to be done to refine the methodology.

Chapter 1

Introduction

In the 2006/7 fiscal year, health sector expenditure in South Africa made up 8.4% of GDP (Blecher, Day, Dove, & Cairns, 2008). Most (58.1%) of this expenditure occurred in the private sector (Blecher, *et al.*, 2008), where medical schemes act as the primary financing intermediaries by collecting contributions, pooling these contributions and purchasing medical goods and services. In 2008 there were 7.88 million beneficiaries covered by medical schemes, representing 15.84% of the population (Council for Medical Schemes, 2009a, 2009b; Statistics South Africa, 2008b) .

Medical schemes are tax-exempt, not-for-profit entities. They purchase medical goods and services in the private sector (i.e. from private practitioners and private hospitals), and thus have an interest in the rate of change in the prices of private medical goods and services. However, there is no commonly-accepted measure of the rate of change in these prices (Da Silva, 2007). Medical schemes also purchase non-medical goods and services, such as third-party administration services, in the course of acting as financing intermediaries. Medical scheme expenditure on both medical and non-medical goods and services exceeded R68 billion in 2008 (Council for Medical Schemes, 2009a).

Members of medical schemes pay monthly contributions to the scheme, on their own behalf as well as on behalf of their dependants. Medical schemes are subject to 'community rating' (where contributions are allowed to vary only by family size, family structure, in terms of adult and child dependants, and income and not by risk factors such as age and health status), resulting in relatively simple contribution tables. Differences arise between the changes in the price of medical scheme cover, as experienced by the consumer, and the changes in the prices of

goods and services experienced by medical schemes. This is because medical scheme contributions are affected by factors other than the price of the goods and services they purchase, which include changes in the benefits offered, changes in the consumption of medical goods and services, changes in quality of care, changes in beneficiary demographics, and changes in solvency margins (Berndt, *et al.*, 2000; Da Silva, 2007). The real price of medical scheme cover near-doubled between 1994 and 2005 (McLeod & Ramjee, 2007), and since 2005 average medical scheme contributions have consistently increased at a rate higher than CPIX (Council for Medical Schemes, 2009a).

This research considers the issues affecting the construction of a price index and proposes a method for constructing an index to monitor the changes in prices of goods and services purchased by medical schemes. Application of the method is demonstrated through the construction of a medical scheme price index for pharmaceutical products based on historical data (for the time period 2006 to 2009) obtained from a medical scheme administrator.

The development of the index methodology is dependent on the targeted users of the index, in this case medical schemes and their boards of trustees. There are, however, other potential users of the index, including parties with whom medical schemes contract, such as medical scheme administrators, managed care companies and medical providers. The regulator (the Council for Medical Schemes) and the national statistical agency (Statistics South Africa) are also likely to have an interest in such an index, as is the National Department of Health (DoH). Given that medical scheme contributions are partially tax-deductible, National Treasury and the South African Revenue Service are also likely to be interested in the factors affecting medical scheme contributions over time.

The intention of the proposed price index is to enable a clearer understanding of price changes in both medical and non-medical items of expenditure as experienced by medical schemes. Whilst medical scheme

administrators frequently provide trustees with data on changes in expenditure, these calculations usually conflate price changes with changes in the mix of goods and services utilised. An index based on a published and accepted methodology would provide trustees with additional information and assist in decision making.

The medical component of the official consumer price index (published by Statistics South Africa) is not appropriate for this purpose as it is constructed from a consumer perspective, and represents both covered and uncovered people. The mix of goods and services demanded by those who are covered by medical schemes is likely to differ considerably from that demanded by those who are not, due to differences in access to medical care arising from *inter alia* affordability differences, geographical differences, differences in the burden of disease and medical scheme benefit design (Newhouse, 2001). Medical schemes enable risk pooling and pre-payment, both of which enhance consumer access to private medical care, particularly that relating to high-cost events.

The medical scheme industry is represented in the official consumer price index (CPI) only to the extent that medical scheme contributions form part of the basket of goods and services covered by that index, although medical scheme data are used extensively to inform the other health components of CPI.

The experience gained in constructing indices for the medical scheme industry could be used to inform the construction of the consumer medical price index both in terms of available data and from a methodological perspective. As the consumer medical price index forms part of the economy-wide consumer price index, biases in the medical price index will lead to biases in the overall price index, particularly as medical care is a large and growing part of the economy (Newhouse, 2001). It is thus important to understand and minimise such biases.

For medical schemes, being able to separate out price changes from changes in overall expenditure will allow a clearer understanding of non-price-related changes in expenditure. Of particular importance to schemes

from a risk management perspective are the effects of changes in benefit utilisation and changes in demographic profile on scheme expenditure (Da Silva, 2007). Similarly, managed care companies need to separate out changes in expenditure so as to be able to demonstrate savings generated, which may arise from effective utilisation management or from managed care interventions directed at reducing prices. In this regard, a series of detailed sub-indices are particularly useful. The possibility of recalculating the indices based on the scheme's own weights, and not industry weights, would also assist with risk management decisions.

Escalation clauses in contracts, such as negotiated fee schedules, may be based on the medical component of the price index (Da Silva, 2007). The availability of an accurate price index also fosters longer-term contracting between medical schemes and providers. The medical component of the index is also of interest to a possible Risk Equalisation Fund as the published tables need to be adjusted annually to reflect price changes. The non-medical component could be used in negotiations with the suppliers of non-medical goods and services, such as medical scheme administrators.

Policymakers use medical price indices to assess the impact of changes in public policy and to inform future policy decisions, such as the need for price controls (Newhouse, 2001). In the South African context, both medical schemes and the regulator will have an interest in measuring the impact of regulatory changes, such as the medicine pricing regulations. The indices can also be used to inform possible future regulation; recent areas of scrutiny include private hospital costs and non-medical costs, such as administration fees.

South Africa is in the process of moving towards a system of National Health Insurance (NHI) and the future of medical schemes in this new paradigm is unclear. The proposed index methodology would need to be revised to reflect the expenditure patterns of the funding entity or entities that may replace the current medical scheme structures. However, much of the underlying rationale for such an index will remain unchanged. If

anything, the pressure on a National Health Insurance Authority to effectively manage its expenditure will be greater than the current pressure on medical schemes, increasing the importance of a relevant and representative price index.

The major limitation of the research is that the proposed methodology was not tested on a complete dataset. The application of the index was confined to pharmaceutical products; expenditure on these products made up 13.4% of medical scheme expenditure in 2008 (Council for Medical Schemes, 2009a). The application was based on data from a medical scheme administrator, representing 12.4% of the medical scheme industry (Council for Medical Schemes, 2009a). As a consequence the data are not necessarily representative of the medical scheme industry. This is of lesser consequence for a pharmaceutical product price index than for other categories of expenditure because, due to the regulation of pharmaceutical prices, price changes are not likely to vary considerably between schemes.

Chapter 2 is a survey of international and South African literature on the general theory of index construction and the health economics theory relating to the interpretation of medical price indices. The South African literature on the factors affecting the goods and services purchased by medical schemes is discussed in Chapter 3. Chapter 4 discusses the South African literature on the factors affecting price determination for medical schemes, such as pricing structure and price regulation. The proposed index methodology is outlined in Chapter 5, together with a discussion of available data. Chapter 6 presents the results of an application of the proposed methodology to pharmaceutical data. Chapter 7 discusses the results obtained and presents suggestions for further research.

Chapter 2

Literature Review – General Theory

The theory of index numbers can be approached both from the perspective of the field of official statistics and from an economic perspective, where the statistical perspective relates largely to index construction, including the determination of the basket of goods and services, how to measure prices, how these prices should be aggregated, the time span the index should cover and the intervals at which it should be calculated. The economic perspective, on the other hand, focuses on the interpretation of the numbers, particularly the relationship between price change and economic welfare.

2.1. Defining price indices

Index numbers are single numbers used to summarise key features of a set of variables. A price index is an index number that reflects the relative price levels over time, and can be used to separate a change in total expenditure into price changes and quantity changes (ILO, *et al.*, 2004).

Prices are influenced by both general factors (that affect all goods and services of interest) and specific factors (affecting particular items). Averaging the price changes of a basket of goods and services allows the effect of the item-specific factors to be reduced (Crowe, 1965), providing an indicator of the general change in the level of prices.

A price index requires a precise definition of the goods and services to be included, based both on the needs of the targeted end-users and the stated purpose of the index. The way in which an index is defined and constructed will determine the potential uses of that index. For example,

consumer price indices reflect the rate of price inflation as experienced by households and thus have a wide range of applications including informing monetary and fiscal policy, the indexing of wages, taxes, transfers and social security benefits, and measuring change in real output and productivity (Newhouse, 2001).

Indices that represent a sub-section of the economy will have more limited applications. Typically a reliable price index for a particular sector would allow the real change in output of that sector to be measured, enabling the productivity levels and economic growth of that sector to be evaluated, and consequently enabling the assessment of structural changes in the sector (Newhouse, 2001). In the medical sector this is complicated by the difficulties associated with measuring the output of the sector. This is because consumers do not value the medical goods and services they are purchasing *per se*; they value the resulting health outcomes. Health economists argue that medical care produces health and health produces utility (Berndt, et al., 2001).

Berndt, et al (2001) argue that measuring the output of the medical care sector in terms of health status is complicated because changes in health status are affected by numerous factors other than medical care including changing demographics of the population (e.g. age), changing disease incidence, changing environmental factors (such as the climate, pollution and violence) and changes in lifestyle. In addition, behavioural factors such as diet, smoking, exercise and the pursuit of risky behaviour are all aspects of the consumer's lifestyle that impact on health. As medical care is only one of a number of factors that impacts on health, the output from the medical sector cannot be measured in terms of the average health of the population. The output of the sector can be "viewed in marginal terms as the health implication of a medical intervention, conditional on lifestyle, environment and other inputs affecting health" (Berndt, *et al.*, 2001, p.149).

2.2. Interpreting price indices

Price indices are often interpreted as representing a change in the cost of living, and in this context “index numbers are essentially devices for converting information about changes in flows of goods or money into some sort of measure of changes in welfare” (Marris, 1958, p. 185). This involves introducing the idea of utility or satisfaction because the change in the cost of living from one period to another is related to the increase in the amount of money required to maintain a certain reference level of utility (Konüs, 1939). A cost-of-living index also involves measuring quality adjusted prices, as quality changes impact on utility (Marris, 1958). This economic interpretation of price indices is often incorrect; the validity of the interpretation will depend on the form of the index (discussed in section 2.4), the factors influencing prices and the extent to which changes in quality are adjusted for.

The cost-of-living interpretation is clearly not valid when an index represents only a sub-section of the market of available goods and services, as is the case with this research. However, this does not obviate the need to understand the extent to which the assumptions necessary for a cost-of-living index hold. It remains necessary to understand the limitations on the interpretation of the index and the extent to which the sub-index can inform an economy-wide index.

The theory relating to cost-of-living indices assumes that the prices paid for goods and services reflect the underlying preferences of consumers, which in turn assumes consumer optimisation and efficiency in the purchase of goods and service. Whilst these assumptions may not hold true for other sectors of the economy, they are particularly problematic for the medical care sector. Berndt *et al.* (2001, p.146) argue that “revealed consumer purchases are not a reliable guide to the marginal value of medical care” because consumer behaviour takes place in the context of asymmetric information and imperfect agency

relationships. The presence of third party payers such as medical schemes further distorts the interpretation of price indices.

Patients, medical practitioners and medical schemes are in a three-way principal-agent relationship. Cutler & Zeckhauser (1999) argue that in addition to medical practitioners acting as agents (in that they make resource-spending decisions on behalf of both patients and medical schemes), financing intermediaries impact on the relationship between patients and providers, both from the demand-side (e.g. patient co-payments) and the supply-side (e.g. how providers are reimbursed).

The medical practitioner plays a dual role: advising the patient on the appropriate treatment and providing that treatment. A misalignment of the interests of the provider and the patient would result in an imperfect agency relationship (McGuire, 2000), allowing the provider to influence the demand for services to take advantage of payment arrangements. Depending on the payment arrangement in place this may either result in supplier-induced demand or under-servicing (Gile & Remler, 2002).

The agency relationship between the patient and provider is affected by the information asymmetry that exists between them. Medical practitioners are better informed than patients about the range of possible treatments, the costs of treatment and the potential outcomes of treatment (Cutler & Zeckhauser, 1999). It is possible for neither the practitioner nor the patient to have the information required to make optimal decisions (Gile & Remler, 2002). The consumer's ability to make rational choices is further affected by the need to make decisions in the face of life-threatening or emergency situations (Hsiao, 1995).

In the context of health insurance (or medical scheme coverage), the term moral hazard refers to the way in which consumers behave when they do not have to pay for medical care themselves, and does not necessarily imply some sort of moral failing on the part of the insured. Moral hazard presents itself in two forms: firstly, that individuals take more risks knowing that they are insured and secondly, that individuals will use more goods or services (or more expensive goods or services) than

if they were paying for them themselves. Cutler & Zeckhauser (1999) argue that the first form is of less significance because health coverage cannot fully compensate for a loss of health. The second form arises because people are insulated from the true costs of health care and because the medical scheme cannot determine the optimal expenditure for each person.

The presence of a third-party payer causes the marginal private costs and the marginal social costs of medical care to diverge. It has the effect of reducing the price of medical care for the individual, resulting in an increase in demand to a point where the marginal social cost exceeds the marginal benefit (Hsiao, 1995). The result is that the observed prices for medical care are not an accurate reflection of the value placed on improvements in health.

The medical sector has experienced and will continue to experience organisational change in terms of how services are reimbursed (e.g. moving from fee-for-service remuneration to capitation). Changes in reimbursement mechanisms alter provider incentives which in turn may alter the demand for services. Managed care has increased the extent of clinical rationing present in the medical market place and has changed the way in which health care is rationed. Rationing mechanisms act as constraints and thus make it more difficult to assess the consumer's willingness to pay, which impacts on the extent to which observable purchases are an accurate reflection of consumer welfare (Berndt, *et al.*, 2000).

Another characteristic of the medical sector is the rapid pace of technological change both in terms of quality improvements and entirely new goods and services. Making explicit adjustments for these changes requires estimating the value of the changes on health outcomes; not adjusting for quality can lead to significant overstatements in the cost of living (Newhouse, 2001). Assumptions need to be made about the monetary worth of health improvements, which is further complicated because there is more than one treatment response that requires

measurement including mortality, morbidity, pain and suffering, functional and emotional impairment and quality of life (Berndt, *et al.*, 2000). It is also difficult to separate the effect of medical care on these treatment responses from various other social, environmental and behavioural factors.

The relationship between medical care, health and utility is further complicated because factors like lifestyle and time are not only inputs in the production of health, but also have a direct impact on utility, and because the current consumption of medical goods and services may impact future health as well as future consumption patterns (Berndt, *et al.*, 2000).

Quality changes arise from a number of sources and are not limited to the introduction of new goods or services. For example, organisational change in medical practices may result in qualitative changes in the supply of treatment and the patient's experience of medical care (Berndt, *et al.*, 2000). Such changes in the qualitative aspects of care impact on consumer utility but are difficult to allow for in a medical price index. Quality change can also occur as medical knowledge improves, for example, where the outcome of a procedure improves over time as surgeons learn by doing (Newhouse, 2001).

Inefficiencies exist in the production of medical care, aspects of which include the overuse of medical services, the underuse of medical services and medical error, for example, the use of an inappropriate setting for care or patients getting the incorrect medication (Newhouse, 2001). Constructing a cost-of-living index assumes that all production is optimal and there is thus no allowance for changes in efficiency that take place over time and the resultant impact on health outcomes (Newhouse, 2001).

The efficiency of the production of medical care depends on the efforts of both the medical practitioner (supplier) and the patient, for example, health outcomes are affected by the knowledge of the provider as well as the knowledge of the patient and producing better health

requires time from both providers as well as consumers (Berndt, et al., 2000). The extent of production inefficiencies will also depend on the extent of managed care intervention, the existence of treatment guidelines, the pace of technological change and the financing mechanisms in place (e.g. the effect of third party payers on overuse) (Cutler & Berndt, 2001; Newhouse, 2001).

2.3. Important characteristics of price indices

A good index should fairly represent the general trend in prices. It is desirable that a price index be accurate, simple and intelligible; the accuracy of an index depends on the choice of formula, the sample size, the sampling methodology and the quality of the original data (Fisher, 1927). Errors in the data may arise from the markets used, the sources of price quotations or the agency collecting the data (Fisher, 1927).

There are practical constraints on index construction, primarily relating to data availability, collection and processing. Constructing a price index is complicated by the vast number of goods and services available and the rapid pace of change: there are new goods and services being introduced on an ongoing basis as well as changes being made to existing goods and services (Boskin, Dulberger, Gordon, Griliches, & Jorgenson, 1998). The relative prices of goods and services change frequently as do buying patterns (Boskin, *et al.*, 1998). Resource constraints may affect the frequency with which data can be collected and processed which in turn affects the usefulness of the index which, ideally, should be published frequently and be made available timeously (ILO, *et al.*, 2004).

2.4. Choice of an index formula

Index numbers are assigned a value of one or 100 at a base date (referred to as the index reference period), and all price changes are expressed relative to this reference period (denoted period 0). Index numbers can be calculated as “a ratio between two weighted averages of two different sets of values of the same set of variables, using the same set of weights for both” (Marris, 1958, p.209). More specifically, a price index can be calculated as the percentage change in the value of an aggregate, holding the quantities constant (ILO, *et al.*, 2004).

The general form of such a fixed-basket index is referred to as a Lowe index, denoted, for our purposes, P_{Lo} (Lowe, 1823, as cited in ILO, *et al.*, 2004). The weight reference period, denoted period b , and the price reference period are differentiated from each other. In the construction of consumer price indices, the weights are usually determined from a household expenditure survey. The weight reference period thus often pre-dates the price reference period due to the time-consuming nature of collecting and processing the data (ILO, *et al.*, 2004). Thus,

$$P_{Lo} = \frac{\sum_{i=1}^n p_i^t q_i^b}{\sum_{i=1}^n p_i^0 q_i^b}$$

Where

t is the current time period

p_i^x is the price of item i in time period x and

q_i^x is the quantity of item i in time period x .

Alternatively, a price index can also be calculated by calculating price changes for each item in the basket of goods and averaging them; the items are then weighted according to the proportion of total expenditure they represent (ILO, *et al.*, 2004). The price movements are referred to as

price relatives: the ratio of the price of a single item at a second point in time to the price of the same item at an earlier point in time (ILO, et al., 2004). The two approaches are mathematically identical if the same assumptions are made.

The Lowe formula can be restated in price relative form as follows:

$$P_{Lo} = \sum_{i=1}^n \left(\frac{p_i^t}{p_i^0} \right) \cdot s_i^{0b}$$

where the expenditure share takes the following form:

$$s_i^{0b} = \frac{p_i^0 q_i^b}{\sum_{i=1}^n p_i^0 q_i^b} \quad .$$

This second approach can be thought of as taking the average of ratios (the price relative approach), as opposed to the ratio of averages (the aggregate approach). The price relative approach is particularly useful where various sub-indices are required or where the effect of a change in one constituent needs to be analysed (Crowe, 1965).

Either way, a price index is simply a weighted average. The choices of possible formulae thus depend on the method of averaging and the possible choices of weights. Due to the forces of supply and demand (amongst other factors) the pattern of relative quantities of goods and services consumed changes over time. There is thus more than one possibility for the choice of weights for a price index, ranging from the pattern of consumption pre-dating the period of comparison to the pattern of consumption at the end of the period of comparison.

There are special cases of the Lowe formula that are discussed extensively in the literature: the Laspeyres formula, denoted here as P_L (Laspeyres, 1871, as cited in ILO, et al., 2004) is where $b=0$ and the Paasche formula, denoted here as P_P (Paasche, 1874, as cited in ILO, et al., 2004) is where $b=t$. The Laspeyres formula can be stated in either

aggregate form (Equation 2.1) or price relative form (Equation 2.2). Similarly the aggregate version of the Paasche formula (Equation 2.3) has a price relative equivalent (Equation 2.4), in this case a weighted harmonic average. These formulae are as follows:

$$P_L = \frac{\sum_{i=1}^n p_i^t q_i^0}{\sum_{i=1}^n p_i^0 q_i^0} \quad (2.1)$$

$$P_L = \sum_{i=1}^n \left(\frac{p_i^t}{p_i^0} \right) \cdot s_i^{00} \quad (2.2)$$

$$P_P = \frac{\sum_{i=1}^n p_i^t q_i^t}{\sum_{i=1}^n p_i^0 q_i^t} \quad (2.3)$$

$$P_P = \left\{ \sum_{i=1}^n \left(\frac{p_i^t}{p_i^0} \right)^{-1} \cdot s_i^{tt} \right\}^{-1} \quad (2.4).$$

The Young index, denoted here as P_Y , is similar to a Lowe index, the only difference being the expenditure shares are kept constant and not the quantities consumed. In a Lowe index the quantities from period b (which pre-dates period 0) are multiplied by the prices from time 0. In a Young index the expenditure shares are assumed to remain constant from time b to time 0 and are thus not updated. The formula takes the following form:

$$P_Y = \sum_{i=1}^n \left(\frac{p_i^t}{p_i^0} \right) \cdot s_i^{bb}$$

where the expenditure share takes the following form:

$$s_i^{bb} = \frac{p_i^b q_i^b}{\sum_{i=1}^n p_i^b q_i^b} \quad .$$

There exists another class of formulae referred to as “symmetric indices”. These formulae make symmetrical use of both price and quantity data in the two time periods being compared. The three formulae commonly used are the Fisher index, denoted here as P_F , the Walsh index, denoted here as P_W , and the Törnqvist index, denoted here as P_T . These three formulae are:

$$P_F = \sqrt{P_L P_P}$$

$$P_W = \frac{\sum_{i=1}^n p_i^t \sqrt{q_i^t q_i^0}}{\sum_{i=1}^n p_i^0 \sqrt{q_i^t q_i^0}}$$

and

$$P_T = \prod_{i=1}^n \left(\frac{p_i^t}{p_i^0} \right)^{\sigma_i}$$

where

$$\sigma_i = \frac{s_i^{tt} + s_i^{00}}{2}.$$

There are two key approaches to the selection of a formula: the so-called axiomatic approach and the economic approach. The axiomatic approach was pioneered by Irving Fisher (1927). He assessed the formulae purely from a mathematical perspective, where price and quantity were treated as independent variables. In the axiomatic approach Fisher runs various tests on alternative index formulae in order to evaluate them.

In applying the axiomatic approach it is important to understand the relative importance of the tests, that is, it is more important to know

which tests are failed than merely the number of tests failed. It is also important to know the extent to which the various tests do not hold. (ILO, *et al.*, 2004)

The two most important tests used to assess whether various formulae produce consistent results or not are the “Time Reversal Test” and the “Factor Reversal Test”. The Time Reversal Test assesses whether the formula produces consistent results when it is applied from the base year to the current year and when it is applied from the current year to the base year. If this is the case the two results multiplied together will yield an answer of one, that is, the price index calculated going forward in time should be the reciprocal of that calculated going backward in time. This relationship holds for any individual item in the basket and should thus, ideally, hold for the basket of items (Fisher, 1927).

The Factor Reversal Test checks whether the formula accurately partitions increases in total expenditure into price increases and quantity increases, that is, whether the price index multiplied by the quantity index yields the increase in value (which is unambiguous) (Fisher, 1927). Again, this holds true for any individual item and should thus, ideally, hold for the basket of items.

Fisher (1927) assessed various price-relative formulae using these two tests and found that there was bias caused both by the type of average used and by the weighting system used, and that the greater the dispersion of the price relatives, the greater the bias. The arithmetic average was found to be biased upward as the product of the formula forward in time multiplied by the formula backward in time is greater than 1. Similarly, the harmonic average is biased downward. Formulae using base-period weights produce downward bias as they give too much weight to small price relatives and, similarly, formulae using current-year weights are biased upward as they give too much weight to large price relatives.

Neither the Laspeyres nor the Paasche formulae fulfil either the Time Reversal Test or the Factor Reversal Test. However, the biases that arise because these axioms do not hold are offsetting; the Laspeyres formula is

a base-period weighted arithmetic average and the Paasche formula is a current-period weighted harmonic average. Both the Laspeyres and Paasche formulae have been found to be only slightly erratic and thus preferable to many of the other candidate formulae (Fisher, 1927).

The symmetric indices also stand up well to the axiomatic approach. The ideal index, from a mathematical perspective, was found to be the Fisher index (Fisher, 1927).

The economic perspective involves selecting a formula that best approximates a cost-of-living index, i.e. a formula that captures shifts in consumption in response to price changes. The Fisher, Walsh and Törnqvist formulae are referred to as “superlative” index formulae in economic literature because these formulae are found to be equal to cost-of-living indices that assume particular forms of indifference curves (ILO, *et al.*, 2004).

The Laspeyres index assumes a “rigid quantitative pattern of consumption” (Marris, 1958, p.244) in that it does not allow for shifts in supply and demand in response to price increases. The Laspeyres index tends to overstate the overall increase in prices because consumers tend to substitute items that have had lower price increases for those that have had higher price increases. This substitution bias is often referred to as the Laspeyres bias, and the extent of the bias will depend on the price elasticity of demand and the extent to which substitutes are available. In this situation the Paasche index will understate the overall increase in price as the weights will reflect the shift towards the items that experienced the lowest price increases. It exaggerates the effect of savings that can be generated through substitution.

The relationship between Paasche and Laspeyres depends on the relationship between price and quantity movements, which are affected by the demand effects described above as well as supply-side effects. Large differences between the Laspeyres and Paasche price index numbers will arise if the weights in the two time periods are significantly

different and if there is a relationship between changes in price and changes in the quantities purchased (Marris, 1958).

The common use of the Laspeyres formula is largely driven by a lack of availability of current expenditure data. In addition, the idea of a fixed basket of goods preserves continuity (Newhouse, 2001). However, as consumer preferences and conditions change over time the items selected for the basket become less representative and the relative importance of items also changes (Newhouse, 2001). This necessitates updating the basket from time to time to avoid the index becoming irrelevant. A change in the weights from time to time will require the series before the change and the series after the change to be linked (ILO, *et al.*, 2004). The relevance of the basket thus depends on the frequency of re-weighting. However, frequent re-weighting may not be practical as it requires a survey of spending patterns which may be time-consuming and expensive (ILO, *et al.*, 2004).

In a chain-linked system, the index number for each period is first calculated relative to the preceding period and then multiplied by all the preceding links back to the base period. Any index formula can be used for the individual links, including an index formula where expenditure weights pre-date the price reference period. The chain-linking methodology is theoretically correct only for comparing any two successive periods because of the changes in weightings over time. The chain system is subject to cumulative error as a bias introduced in any period will be carried forward. This “path-dependence” means that chain-linking should not be used where prices oscillate, but only where prices change roughly monotonically (ILO, *et al.*, 2004).

Boskin *et al.* (1998) advocate the use of formulae that require updated quantities. In particular the symmetric (superlative) indices have the advantage of being compromise formulae between base-period weights and current-period weights. They do, however, recognise that in addition to the need for accuracy there is also a need for timeliness and that these two requirements conflict because constructing a more accurate (or

theoretically correct) index requires time to collect more up-to-date information.

2.5. Sampling considerations

The vast number of goods and services available, together with limitations on data availability, often make it necessary for a price index to be based on a representative sample of goods. The sampling methodology and sample size greatly affect the accuracy of the index and the choices made will influence whether the items in the basket are representative, relevant and reflect the primary purpose of the index (Crowe, 1965).

The sample of goods and services to be included in the basket is usually determined using an expenditure survey. The entities surveyed would be those whose expenditure the survey represents, for example, for a consumer price index one would conduct a household expenditure survey. The selection of entities to include in the survey also requires a sampling methodology, and requires that a weight be ascribed to each entity. In the so-called democratic approach all entities are treated as equal, as opposed to the so-called plutocratic approach where each entity is weighted according to its level of expenditure. Differences between the two approaches will depend on the extent to which different entities face different prices (ILO, *et al.*, 2004).

If prices are to be obtained from outlets (that is, providers) and not from the purchasers, a sampling methodology is also required to select those from which to obtain price quotations. The American Bureau of Labour Statistics conducts a point-of-purchase survey where the probability of outlet selection is based on consumer expenditure; price changes are calculated as they occur within outlets and no substitution between outlets is allowed for (Boskin, *et al.*, 1998).

This is estimated to create an upward bias in the American CPI calculation due to retailing trends which have resulted in consumers

switching from higher-cost to lower-cost outlets (Boskin, *et al.*, 1998). This is less of an issue if price differences between providers reflect differences in quality, for example, lower-cost medical providers may have longer waiting times, shorter consultation times and less comfortable surroundings. In the medical scheme context price data can be obtained from the purchaser, averting the need to sample medical providers.

Due to the time-consuming and data-intensive nature of calculating a price index, purposive sampling is sometimes used. Purposive sampling is more cost-effective, particularly where “clusters” of data can be collected. For example, instead of sampling medical scheme options to estimate expenditure weights, data could be collected from a single medical scheme administrator that administers multiple medical schemes. Purposive sampling is problematic in that it introduces subjective factors which means that sampling error cannot be calculated (ILO, *et al.*, 2004).

2.6. Constructing the basket of goods and services

The sampling methodology will affect the weighting structure of the index, in that weight data will only be available for sampled items. Fisher (1927) refers to the concept of double-weighting (calculating weights for individual items and for categories of items) as a means of ensuring accuracy. If only the individual items are weighted, some categories may be given more weight relative to other categories if expenditure on the sampled items is a higher proportion of expenditure for those categories. Statistics South Africa (Haglund, 2000) and the American Bureau of Labour Statistics (Boskin, *et al.*, 1998) make use of a hierarchical or pyramidal structure in the construction of their Consumer Price Index where weighting occurs on multiple levels.

The particular issues that need to be considered in the construction of the basket of goods and services to be priced include the treatment of seasonal goods and services, the choice of categories of expenditure and the definition of a unit of service.

Whilst medical goods and services tend to be available throughout the year, the quantities demanded may fluctuate according to the time of the year. Particular diagnoses are climatic (e.g. allergic rhinitis) whilst other fluctuations may relate to benefit availability and practical considerations. For example, the scheduling of discretionary procedures decreases during school holidays.

The existence of seasonal variation means that the time period upon which expenditure weights are based will affect which items are included in the basket. There may also be breaks in the price series if there are months during which particular goods or services are not purchased. Possible solutions include excluding seasonal items from the basket or introducing the concept of a rolling year-on-year index (ILO, *et al.*, 2004). The appropriate solution will depend on the extent of the problem.

The choice of categories of expenditure for the basket is important because a fixed-weight index such as a Laspeyres index does not allow for substitution between categories of expenditure in the periods between updating of weights. For example, if in-patient and out-patient services fall into different categories, a shift in procedures from being in-patient to out-patient will cause the clinical severity of cases in both settings to increase, although the total costs of treatment will reduce. Thus the saving as a result of a shift from in-patient treatment to out-patient treatment will not be captured. Similarly, savings that arise from a shift from surgical treatment to drug treatment will not be captured. These effects are reduced by updating the basket more frequently or using a formula that makes use of current weights.

An alternative approach would be to base the basket on episodes of treatments for various diseases as opposed to basing it on specific goods and services, in which case the weights would need to be based on the

money expended on various diseases (Newhouse, 2001). The idea of an episode of illness or treatment has become common place in contexts outside of medical price indices. Examples include the development of clinical practice guidelines and treatment protocols, as well as the emergence of disease management programmes (Berndt, *et al.*, 2000).

The choice of the unit of service for the service component of the basket may significantly influence the results obtained, for example, the unit of service for the hospital component of the basket could be a day in hospital or an admission (Newhouse, 2001). If the average length of stay in hospital decreases this would cause the average severity of a day to increase (because the first few days of treatment are more expensive than later days). As a result the average cost per day in hospital would increase. Thus, using a day as the unit of service will overstate the increase in price. To solve this problem the hospital services component of the producer price index in the United States treats a change in the length of stay as a quality change as opposed to measuring hospital services by admission (Berndt, *et al.*, 2000).

At the lowest level of an index, elementary price indices are estimated. The elementary price indices are based on small and fairly homogeneous sets of products (for example, Panado in different forms such as liquid, capsule and tablet, and in different pack sizes), and are most often calculated without the use of explicit expenditure weights due to limitations on data availability (ILO, *et al.*, 2004). The sampling methods can mean that the products are implicitly weighted, for example, products may be selected with probabilities proportional to sales (ILO, *et al.*, 2004).

The lack of weighting means that simple averages are used. As with the higher level formulae, elementary price indices can be in aggregate form or price relative form. The three options are the Carli index (the simple arithmetic mean of price relatives), the Dutot index (the ratio of un-weighted arithmetic mean prices) and the Jevons index (the un-weighted geometric mean of price relatives) (ILO, *et al.*, 2004).

Elementary indices can be calculated either as direct or chain-linked indices (direct indices compare the current price with the price in the base period, whilst the chain indices compare the current price with that in the preceding period). It is computationally easier to deal with missing prices, replacement items and quality changes if chain-linked indices are used (ILO, et al., 2004). However, only the Dutot index and the Jevons index are transitive and the use of a chain-linked Carli index leads to systematic upward bias in the index (ILO, et al., 2004).

Statistics South Africa (2009) uses a Jevons index, denoted here as P_J , at elementary aggregate level. Based on both the axiomatic approach and the economic approach (as in section 2.4) the Jevons formula is found to be the preferred choice (ILO, et al., 2004). However, as it is a geometric average it equals zero if one price relative is zero, and is sensitive to extreme falls in price (ILO, et al., 2004). The Dutot index, denoted here as P_D , can be used in situations where there is little or no price substitution, that is, where relative quantities remain fixed whatever the relative prices (ILO, et al., 2004). The formulae are as follows:

$$P_J = \prod_{i=1}^n \frac{p_i^t}{p_i^0}$$

$$P_D = \frac{\sum_{i=1}^n p_i^t}{\sum_{i=1}^n p_i^0}.$$

2.7. Obtaining price data

The medical care market is characterised by both price dispersion (price varying by supplier) and price discrimination (suppliers offering different prices for different segments of the market) (Berndt, et al., 2000). In part, this is because medical services are not re-sellable (i.e., there is no possibility for price arbitrage) and because price competition requires

advance price information (Berndt, et al., 2000). This is often absent in health care as the price of treatment depends on factors not known in advance, such as the diagnosis and an individual's recovery rate, and it is unlikely that a consumer will undertake price comparisons in a life-threatening or emergency situation (Berndt, *et al.*, 2000; Hsiao, 1995).

The procedures used to collect price data for a medical price index need to take these features of the market into account. Where there is no price discrimination, price data can be obtained from a single payer, which in the case of this research would be a medical scheme. The existence of price discrimination in a market requires that the payer is taken into account in the sampling procedures. Where there is no price dispersion, price data from a single supplier will represent the market; the greater the extent of price dispersion, the more important sampling procedures for outlets/providers will be.

The existence of observable prices will depend on the nature of the health system. Systems that operate on the allocation of a global budget to providers, where goods and services are provided with little or no direct charge to the consumer, will have no observable transaction data. In the absence of observable prices a medical price index must be based on input prices such as wages (Newhouse, 2001).

Price aggregation also impacts on the extent to which prices are observable. The appropriate level of aggregation to be used in the price index is usually dictated by how the market prices for products and services; however, the extent to which prices are aggregated is not consistent in health care as different payers pay for medical services in different units and these may change substantially over time (Cutler, McClellan, Newhouse, & Remler, 1998). The level of price aggregation used depends on the reimbursement mechanism, which may range from fee-for-service reimbursement (highly disaggregated), to the payment of

*per diem*¹ rates, per case rates and capitation rates (a fixed amount per person per time period).

The producer price index in the United States constructs a price index for physician services by randomly selecting a bill and then using diagnosis and procedure codes to re-price the bill (Berndt, *et al.*, 2000). The bill covers the entire set of services provided during a patient visit, split by payer. Similarly the price index for hospital services is based on the same idea of re-pricing a bill (Berndt, *et al.*, 2000). Statistics South Africa has recently adopted this methodology for the hospital services component of the CPI (Kelly, 2009). This methodology addresses problems arising from changes in reimbursement arrangements over time.

Where observable prices are available, the index can be based on either list prices or transaction prices. Whilst list prices are often easier to obtain, they may result in a bias, for example, managed care organisations may negotiate with hospitals to pay a fee that is less than the list price (Newhouse, 2001). The greater the extent of negotiation between managed care organisations and medical service providers, the greater this discrepancy is likely to be. In many countries, differentials between list prices and transaction prices are also common in the pharmaceutical industry due to the effect of the discounts, rebates and “kick-backs” that are common practice in this industry. Obtaining transaction prices is complicated because of price discrimination between insurers and because transaction prices are often considered confidential and proprietary by insurers (Berndt, *et al.*, 2000). Statistics South Africa has recently moved away from using list prices for the health component of CPI to using transaction prices (Kelly, 2009), largely enabled by a closer working relationship with the private sector.

¹ Reimbursement based on a negotiated rate per day (as opposed to charges per good or service). The rate per day may vary by the type of admission and the intensity of care. (McLeod, 2009)

2.8. Updating basket weights and dealing with changes in quality

In the medical sector there are rapid technological changes and frequent introductions of new goods and services. The problem of having a fixed basket of goods and services that does not reflect changes in consumption is not confined to the medical sector. However, for other sectors the problem of having a constant basket relates primarily to the substitution effect. This is less of an issue in the medical sector as consumers do not make quantity decisions on the basis of price alone, and the bias that results from having a fixed basket is thus not necessarily an upward one (Cutler, et al., 1998).

Changes in the composition of the list of goods and services available to consumers would not be a problem if the price changes for new items were the same as those for existing items. However, new goods often show atypical price development (Marris, 1958). Technological change in the medical sector may also result in a significant shifting across categories of expenditure (e.g. from in-patient to out-patient), causing the fixed-base weights to become out-of-date quickly (Newhouse, 2001).

There are a large number of new product introductions in the medical sector, particularly pharmaceuticals. Typically new goods would only be taken into consideration when the basket is updated, which could result in considerable delays. An alternative approach would be to do supplementary sampling; however, there may still be a delay in recognising that a new good has entered the market. A significant delay may lead to an upward bias in the index as prices often fall after their initial introduction to the market. The fall in prices may be due to increasing economies of scale and increases in production runs. A study by Berndt, Griliches, & Rosett (1992) found that the prices of pharmaceutical products late in their life cycle increased more rapidly than those of products early in their life cycle.

Once new goods have been identified, they need to be introduced into the basket. In the addition-and-deletion approach the old good is removed from the index and the new good added such that the overall index is left unchanged; in other words, the price difference between the two goods is not captured; only the subsequent changes in price. The assumption here is that the price difference between the products represents the consumer valuation of any quality difference, which in turn is based on an assumption that the market is efficient (Newhouse, 2001). The arguments for why this assumption is unlikely to hold for medical goods and services were presented in section 2.2.

Alternatively the price difference between the old and new goods may be reflected in the index with no adjustment for changes in quality: any difference in price is reflected as a pure price increase regardless of whether part of the price differential can be attributed to quality differences (Newhouse, 2001).

Generic drugs are a special case of “new goods”: they are essentially an old good under a new label. They need to be allowed for because of the dramatic pricing differences that exist between generic drugs and patented drugs. In the American market, generic drugs typically enter the market at about a one-third discount to the patented drug and the discount tends to rise as more generic producers enter the market (Newhouse, 2001). Using an addition-and-deletion approach would result in the price difference between patented drugs and generic equivalents not being captured.

Berndt *et al.* (2000) describe how generic drugs are allowed for in the American consumer price index and in the producer price index. The approach for the consumer price index is as follows: six months after patented drugs lose their patent protection the Bureau of Labour Statistics randomly selects from branded and generic versions of the drug where the probability of being selected is linked to the volume of sales in that month. If a generic drug is selected then the entire price difference between the generic and the branded product is treated as a price change.

This is essentially a once-off possibility for substitution before the basket is next updated. The criticism of this method is that six months may not be long enough for certain generics to gain market share.

The producer price index approach is different in that drugs in the sample that lose patent protection have their weight split for the generic equivalent and the brand. The price change is then treated as a pure price change. The split used to be 64.2% for the generic and 35.8% for the branded product and is now split on the value of sales. The impact on the index depends on the timing of when this is done (Berndt, *et al.*, 2000).

Neither the addition-and-deletion approach nor the approach where price differences are captured in full make explicit allowance for changes in quality and thus do not make allowance for the impact of new products on consumer welfare (Newhouse, 2001). Making explicit adjustments for quality raises the issues identified in section 2.2 relating to the complex relationship between medical care, health and utility. Newhouse (2001) argues that the problems with medical price indices persist because the methods which are more theoretically correct are difficult or costly to implement. Possible approaches include hedonic analysis, demand analysis and clinical outcomes research.

The hedonic approach to quality adjustments makes use of regression analysis where the price of a medical good or service is the dependent variable, and the attributes of the medical procedure, the provider and the patient are the explanatory variables (Newhouse, 2001). This approach uses an estimate of market prices for the key attributes of the medical procedure to adjust for quality change by separating price changes over time into changes attributable to improvements and pure price change. However, the parameters in the regression would be based on data reflecting the inefficiencies of the medical care market that arise due to, *inter alia*, the effect of moral hazard and agency problems which makes it difficult to derive economic welfare implications from the results of the analysis (Berndt, *et al.*, 2000).

Hedonic price analysis can also be implemented at the level of a medical scheme option. Here the dependent variable would be the price of cover and the explanatory variables would be the attributes of the benefit option. This approach would require that factors such as the profile of people on the option be controlled for, and it requires an understanding of how consumers select benefit plans, including issues of moral hazard, anti-selection and employer decision-making. However, inefficiencies may arise in the medical scheme market because consumers are not fully aware of the good they are purchasing (Berndt, *et al.*, 2000).

The other approach to quality adjustments involves creating explicit models of individual demand for health care. Making assumptions about the way in which treatment decisions are made assumes that consumers have a specified distribution of preferences or that consumers are making decisions for goods and services where they bear a high proportion of the costs themselves (Berndt, *et al.*, 2000). Consequently, this approach does not work well for medical care because consumer information is poor and, where consumers have comprehensive private medical insurance, out-of-pocket expenditure is relatively low.

Clinical outcomes research aims to overcome these problems. It involves looking outside of market transactions, with analyses done on an illness-by-illness basis. The approach requires a sample of a representative mix of illnesses to allow for the extent to which medical care progress has varied by illness.

2.9. Theoretical development of medical price indices in South Africa

2.9.1. The medical component of CPI

Statistics South Africa follows the methodological guidelines in the International Labour Organisation (ILO) manual when compiling the South African CPI. The manual provides the theory and conceptual framework, together with methodological and practical guidelines for the compilation of consumer price indices. The ILO is viewed as being the authoritative body on the topic of consumer price indices. Statistics South Africa also works with a number of professional expert groups such as the United Nations International Working Group on Price Indices and the ILO/United Nations Economic Commission for Europe (UNECE) joint meeting to ensure that the CPI methodology keeps pace with international best practice (Statistics South Africa, 2009).

The current South African CPI weights are largely based on the 2005/6 Income and Expenditure survey (IES) which was released in March 2008. The survey ran from September 2005 to August 2006, allowing for a 12-month period in which seasonal expenditure patterns were identified. Statistics South Africa uses a sampling methodology for items to include in the basket based on a combination of expenditure and frequency, the intention being to exclude very high-cost, low-frequency items (luxury goods) and also to exclude very high-frequency, low-cost items (Statistics South Africa, 2009).

Weights represent the proportions of total consumption expenditure of households, and are updated every five years (Statistics South Africa, 2009). Prices are updated on a monthly, quarterly or annual basis with a Jevons index being used for the elementary aggregates and a Young index

being used for higher-level aggregation (Statistics South Africa, 2009). The index is published monthly.

The most recent re-weighting of the CPI was used as an opportunity to overhaul the index. Relevant changes include a streamlining of the basket of goods and services and the introduction of a new classification system (Kelly, 2009). Of particular relevance is the reclassification of medical scheme contributions from “Medical care and health expenses” in the old system to “Miscellaneous goods and service” in the new system. The new classification (as it relates to medical expenditure) is given in Table 2.1.

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Table 2.1 Classification of medical goods and services, and health insurance in the Consumer Price Index

Category	Class	Group	Indicator Product
Health	Medical products, appliances and equipment	Pharmaceutical products	Pain killers
			Cough mixture
			Vitamin and mineral supplement
			Sinus medication
			Fungal medication
			Cold and flu medication
			Heartburn medication
			Muscle pain relief gel
			Sore throat lozenges
			Laxative
			Dispensing fees
	Out-patient services	Medical services	General Practitioners
			Obstetricians and Gynaecologists
			Physicians
			Paediatricians
	Hospital services	Dental services	Dentists
		Hospital services	Medical
			Surgical
			Maternity
Miscellaneous goods and services	Insurance	Insurance connected with health	Health insurance

Source: Statistics South Africa (2009)

As can be seen in Table 2.2, the health category of the index now has a significantly lower weighting (down from 6.90% to 1.47%) (Kelly, 2009). This is only partly accounted for by the re-classification of medical scheme contributions. Differences may have arisen due to changes in the IES, for example, the most recent survey makes use of both recall and diary

methods whereas previously only recall methods were used (Statistics South Africa, 2009).

Table 2.2 Updated health weights in the Headline Consumer Price Index (2000 and 2008)

Headline CPI	2000	2008
Total health	6,90 (includes insurance)	1,47 (excludes insurance)
Medical professionals	2,25	0,72
Hospital services	0,63	0,18
Medical products	2,47	0,57
Medical equipment	0,14	n/a
Medical insurance	1,51	3,68

Source: Kelly (2009)

The collection of prices for medical goods and services has also been improved. Prices for prescribed pharmaceutical products are obtained from electronic real-time data (from a company that facilitates electronic submission and processing of accounts) (Statistics South Africa, 2009). The selection of pharmaceutical products for pricing was done using data from the same source, representing approximately 90 per cent of all transactions between pharmacies and medical aid schemes (Statistics South Africa, 2009). Transaction prices are used, and dispensing fees are taken into account (Kelly, 2009). The index thus largely ignores doctor-dispensed pharmaceuticals.

Prices are not collected for all types of medical practitioners, but only for general practitioners, gynaecologists and obstetricians, paediatricians, physicians and dentists (Statistics South Africa, 2009). Transaction prices are used (based on a national survey of 550 practitioners), whereas in the past list prices were used (i.e. drawn directly from the National Health Reference Price List, NHRPL) (Kelly, 2009). The sample is drawn from a Board of Healthcare Funders (BHF) database, based on the benefits paid by medical aid schemes in 2006 to each of the practitioner types (Kelly, 2009). This represents a significant improvement as practitioners

frequently charge fees in excess of the NHRPL. Prices are obtained for consultations and limited (out-of-hospital) procedures, as well as for different classes of patient (e.g. private patients and medical scheme patients) (Statistics South Africa, 2009). Collecting prices for patients that belong to medical schemes recognises that these patients frequently encounter out-of-pocket expenditure.

Previously only public hospitals were reflected in the index; now only private hospitals are reflected (Kelly, 2009). This recognises that uncovered lives are not limited to making use of the public sector, and that private hospitals report increased usage by uncovered lives (Matsebula & Willie, 2007). The sample frame was based on data from the Hospital Association of South Africa (HASA). The sampling takes into account larger private hospital groups, each of which had to have a share of 15% or more of registered hospitals to be included (Kelly, 2009). Transaction prices are also used for hospitals: a sample of surgical admissions, medical admissions and maternity accounts are selected at the beginning of each year and subsequently re-priced on a quarterly basis (Kelly, 2009). This is an improvement on using list prices for ward costs, theatre costs and consumables, and allows for shifting between the categories as well as alternative reimbursement agreements.

2.9.2. Recent work on private sector medical price indices

The research done by Da Silva (2007) is of key relevance. It is the only piece of South African medical price index work, based on medical scheme data that is in the public domain. The index is intended to reflect price changes as experienced by medical scheme beneficiaries. The work was based on a dataset obtained from Discovery Health Pty (Ltd) reflecting the claims experience of nine medical schemes over the period January 2001 to November 2005. Da Silva (2007) does not comment on the quality of

the Discovery dataset used in her research, except to say that duplicate claims were excluded. Discovery market share, in terms of numbers of beneficiaries, ranged from 17.7% in 2002 to 26.5% in 2005 (Council for Medical Schemes, 2006a). The dataset is thus likely to have been broadly representative of the market. There are, however, biases in the results that reflect the influence of a single administrator, for example, a drop in chronic medication prices is observed in January 2004 and this is attributed to the introduction of a drug formulary by the administrator.

Da Silva (2007) used a sub-set of claims data based on the frequency with which an item was claimed, with the sample size ranging between 70% and 80% of a category. A retrospective check was done to ensure that the index covered at least 50% of expenditure.

The definition of price used by Da Silva (2007) is the full price claimed by the beneficiary (referred to as the “account amount”) and not the price reimbursed by the medical scheme. The expenditure weights used to calculate the index are thus based on the product of the number of claims and claimed amount, and not the actual scheme expenditure in each category.

Table 2.3 compares the Da Silva weights to the overall medical scheme expenditure weights obtained from the 2006 Council for Medical Schemes annual report (reflecting 2005 data). The weights for the specialist category and the general practitioner category are lower than the medical scheme expenditure shares. These are the categories where beneficiaries are most likely to be charged a price higher than the maximum the scheme will reimburse.

Table 2.3 Comparison of category weights between the Da Silva index and medical scheme industry expenditure

	Da Silva (2005 data)*	The Council (2005 data)
Hospital	39.0%	39.1%
Specialist	25.0%	20.7%
Pharmaceutical	16.0%	15.6%
General Practitioner	8.0%	7.1%
Other	11.0%	17.5%

Source: Da Silva (2007); (Council for Medical Schemes, 2006a)

* these numbers were taken directly from the Da Silva (2007) paper where they do not add to 100% due to rounding.

The formula used by Da Silva (2007) was described as a chain-linked Laspeyres formula, with weights based on expenditure over a three-year period. Da Silva (2007) refers to making use of annual weights in some cases to allow for the introduction of new codes, it is, however, not clear how the three-year weights and annual weights were integrated.

Da Silva (2007) based the pharmaceutical component of the index on pharmaceutical claim lines, i.e. on the price per pack, not the price of each unit within a pack. The unit of service used for hospital claims was a hospital event and the chosen unit of service for all other medical claims was the NHRPL tariff code.

Both Mediscor and Medikredit, clearing houses for pharmaceutical claims², publish pharmaceutical price indices. However there is little information about the indices available in the public domain. The Medikredit index was created to measure the effect of the introduction of Single Exit Pricing for pharmaceuticals, and covers 86% of medicines available in South Africa (Jones, 2005). The index is restricted to pharmaceuticals used outside of hospital, and weights are calculated on annual data to remove seasonal effects (Jones, 2005). Email contact with Medikredit in an attempt to obtain further information was unsuccessful.

² Medicine clearing houses enable on-line real-time claims processing for pharmaceutical claims by interfacing between medical schemes and pharmacies.

The results of the Mediscor index have been presented at a conference (Bester, 2009) but the methodology was not published. No meaningful analysis can be done without understanding how the Mediscor numbers were calculated.

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Chapter 3

Literature review - factors influencing the mix of goods and services purchased by medical schemes

This chapter is not intended to be a comprehensive discussion of all the factors that could possibly affect medical scheme purchasing patterns. Rather, the intention is to highlight those factors that have been of particular importance over the period analysed (2000-2009).

3.1. Goods and services purchased by medical schemes

Data on the major categories of medical scheme expenditure can be found in the Council for Medical Scheme (the Council) reports which are compiled from the annual returns submitted by schemes. The most recent report available, published in 2009, reflects 2008 expenditure. Data for 2009 will only be available in the latter half of 2010.

In 2008 expenditure on non-medical goods and services made up 14.3% of total expenditure (Council for Medical Schemes, 2009a). The relative expenditure on non-medical items increased between 2000 and 2001 (from 13.9% to 16.3%) but has been declining since 2005 (Council for Medical Schemes, 2001, 2002, 2003a, 2004, 2005, 2006a, 2007, 2008b).

Based on the Council annual reports, the five major categories of medical expenditure for registered schemes are 'hospital', 'medical specialist', 'pharmaceutical', 'general practitioner' and 'dental'. The split between these categories is illustrated in Figure 3.1.

The definitions of these categories used throughout this work are broadly consistent with those used by the Council. It should, however, be noted that precise definitions of benefit categorisation may vary between schemes, and whilst the financial data in the annual returns are audited, these detailed data are not.

‘Hospital’ expenditure refers to items billed by hospitals (ward fees, theatre fees, consumables, medicines dispensed in hospital, *per diem* arrangements and other alternative reimbursement arrangements), and not all expenditure occurring whilst a patient is being treated in hospital. It includes both private and public hospitals, although expenditure on public hospitals has declined to less than 0.94% of ‘hospital’ expenditure (Council for Medical Schemes, 2009a).

‘Pharmaceutical’ expenditure includes all expenditure on pharmaceutical items regardless of the dispensing practitioner, the only exception being pharmaceuticals used in hospital (Rama & McLeod, 2001). Pharmaceutical benefits offered by medical schemes are typically split into benefits for acute medical conditions and medicines for chronic medical conditions³. Medicines taken home from hospital typically form part of the acute pharmaceutical benefits. Unfortunately, the split between acute and chronic benefits is not available from the Council annual reports.

The ‘dental’ category includes all non-pharmaceutical items billed by dental practitioners (including dental specialists). Similarly the ‘general practitioner’ and ‘medical specialist’ categories reflect all non-pharmaceutical items billed by those practitioners. The category ‘other’ is made up of expenditure on the supplementary and allied health professionals (including optometrists and physiotherapists), ex-gratia payments, capitated primary care arrangements and a range of miscellaneous items (including blood transfusion services and prostheses). (Council for Medical Schemes, 2007)

³ The differentiation between acute conditions and chronic conditions may vary between schemes but typically depends on the period of treatment needed, with chronic care being more long-term in nature. (Fish, Ramjee, Richards, & Hongoro, 2006)

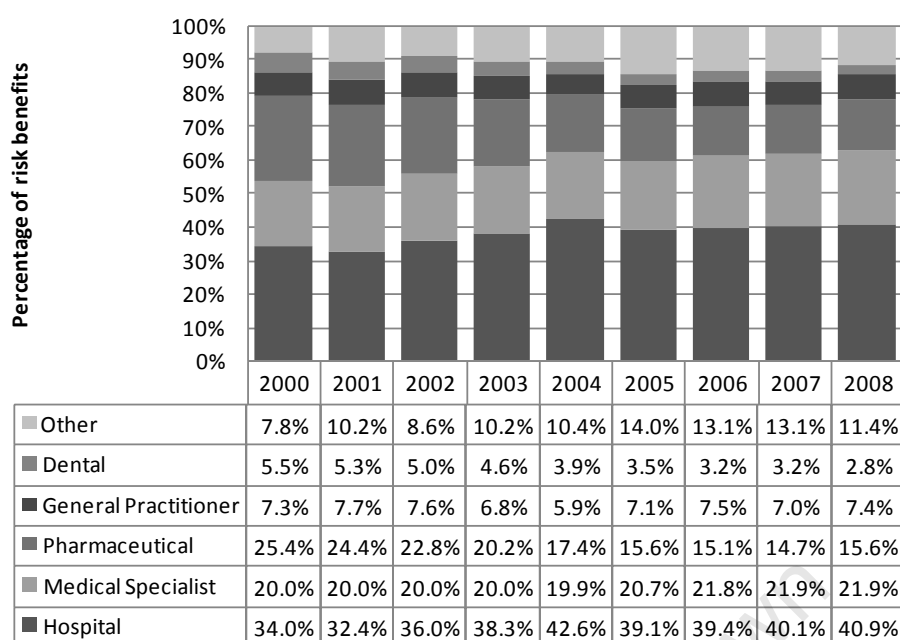


Figure 3.1 Risk benefits for open schemes and restricted membership schemes by category of expenditure (2000-2008)

Source: Data compiled from Council for Medical Schemes Annual Reports 2001 to 2009

(Council for Medical Schemes, 2001, 2002, 2003a, 2004, 2005, 2006a, 2007, 2008b, 2009a)

The split between the categories (Figure 3.1) has changed significantly over the period. In recent years, the emphasis has shifted from schemes providing both major medical cover (encompassing in-patient care and the treatment of chronic disease) and day-to-day cover to a focus on just major medical care (McIntyre & Thiede, 2007).

The category 'other' increased substantially from 2004 to 2005. This was largely due to an increase in capitated primary care arrangements⁴ (Figure 3.2). The item 'pharmacist' appears in the Council reports from 2005 – this relates to the fees (over and above dispensing fees) that pharmacists are now able to charge. This has seen a portion of expenditure that would previously have been part of pharmaceutical expenditure (in the form of a mark-up) being shifted to 'other'.

⁴ Arrangements where, typically, the funder pays a negotiated monthly amount to a primary care provider per person registered with that provider. In return, the provider assumes responsibility for the primary medical care for that person. The provider receives the monthly fee regardless of whether the registered person makes use of their services or not. (Actuarial Society of South Africa, 2008)

Expenditure attributed to medical technologists has also increased over the period. The reasons for the decline in the “other” category between 2005 and 2008 are not clear.

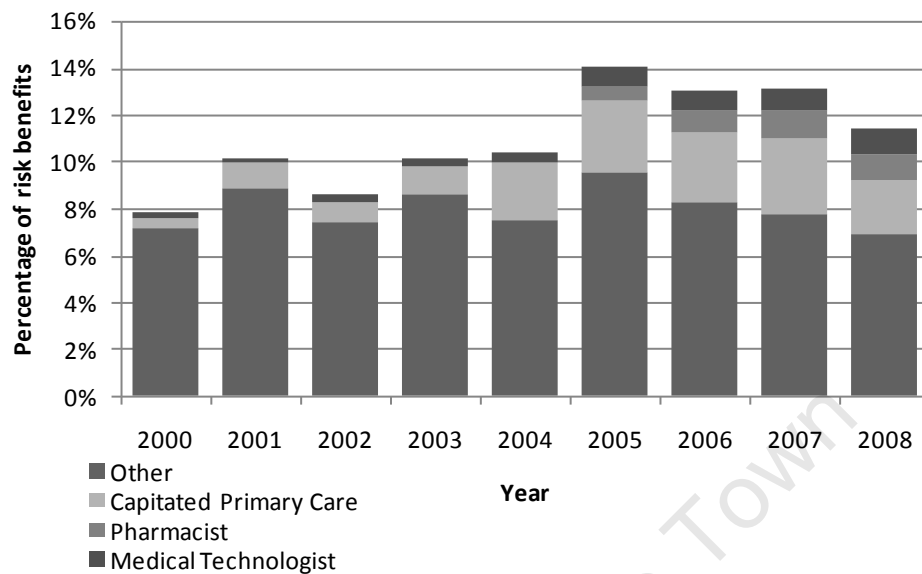


Figure 3.2 ‘Other’ benefits for open schemes and restricted membership schemes as a percentage of risk benefits (2000-2008)

Source: Data compiled from Council for Medical Schemes Annual Reports 2001 to 2009

(Council for Medical Schemes, 2001, 2002, 2003a, 2004, 2005, 2006a, 2007, 2008b, 2009a)

Figure 3.3 illustrates the breakdown of non-medical expenditure into its major categories: ‘administration’, ‘managed care’ and ‘acquisition’.

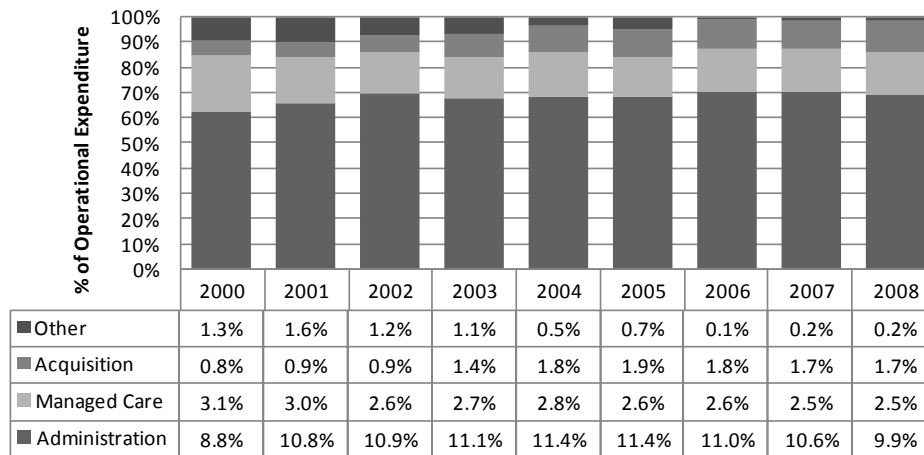


Figure 3.3 Breakdown of non-medical expenditure for open schemes and restricted membership schemes as a percentage of operational expenditure (2000-2008)

Source: Data compiled from Council for Medical Schemes Annual Reports 2001 to 2009

(Council for Medical Schemes, 2001, 2002, 2003a, 2004, 2005, 2006a, 2007, 2008b, 2009a)

Administration expenditure is made up of both administration fees paid to third party administrators and other expenses incurred directly by the scheme (including trustees' fees, audit fees and staff remuneration) (Rama & McLeod, 2001). Managed care expenditure relates only to the purchase of managed care services, and not to managed care arrangements that include a transfer of risk. These arrangements are included under underwriting expenditure. Acquisition in this context refers to the acquisition of new members and includes expenditure on brokerage fees and marketing.

The category 'other' includes bad debts (referred to as 'net impairment losses: trade and other receivables') and the net reinsurance result (reinsurance premiums less reinsurance recoveries). Reinsurance is classified as a non-medical expenditure and not as part of underwriting expenditure for historical reasons. This is discussed further in section 3.4.5.

Contributions to reserves and investment-related cash flows are not discussed here as they do not relate to the consumptive activities of medical schemes.

3.2. Differences between open schemes and restricted membership schemes

There are three types of medical schemes in South Africa: schemes which allow public membership (open schemes), schemes which limit membership to pre-defined groups of people (restricted membership schemes) and bargaining council schemes. Bargaining council schemes, which are regulated in terms of labour relations legislation, differ considerably from open and restricted schemes in that they offer different benefits, as Prescribed Minimum Benefits do not have to be provided, and they tend to have lower levels of contributions.

The most recently available data (relating to the 2004 benefit year) indicate that bargaining council schemes account for only 3.66% of medical scheme beneficiaries, and an even lower 1.30% of net contributions (Council for Medical Schemes, 2005).

Expenditure patterns differ between open and restricted membership schemes, as shown in Figure 3.4, reflecting differences in their relationships with stakeholders such as brokers and employers, differences in competitive dynamics as well as differences in size and structure (McLeod & Ramjee, 2007).

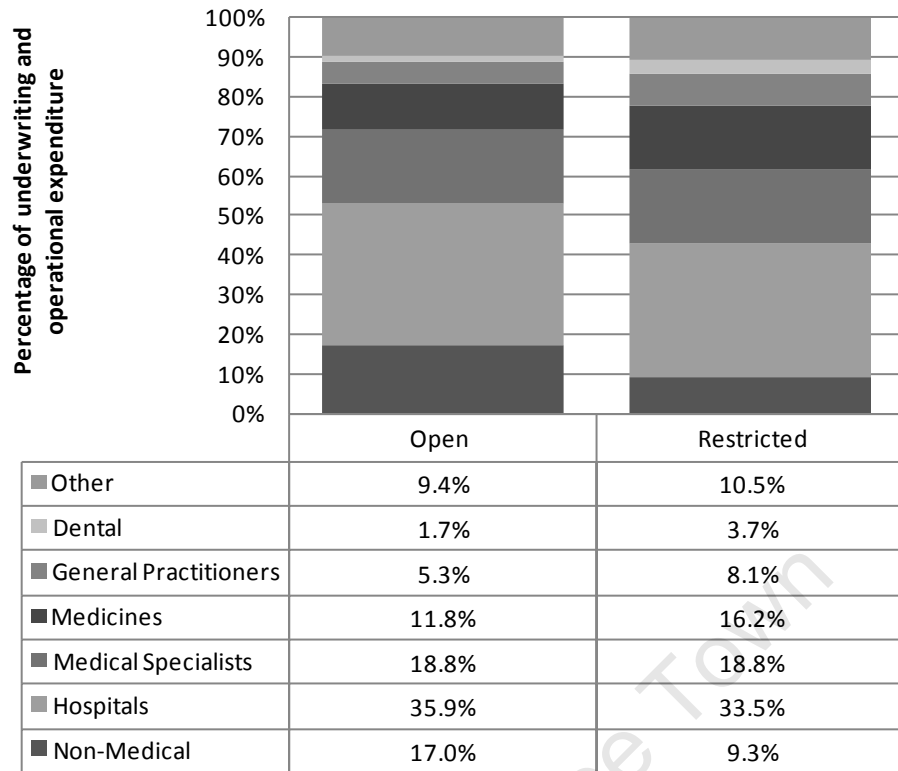


Figure 3.4 Split of underwriting and operational expenditure for open schemes and restricted membership schemes (2008)

Source: Council for Medical Schemes Annual Report 2008-9 (Council for Medical Schemes, 2009a)

Non-medical expenditure is lower amongst restricted schemes (10.1% of expenditure as opposed to 17.7%), partly because restricted schemes do not need to incur the costs of attracting members (expenditure related to 'acquisition'). Restricted schemes also have lower administration fees on average (Council for Medical Schemes, 2007), partly because there are fewer benefit options per scheme. The collection of contributions is also simpler given that the administrator usually only has to deal with a single employer.

Restricted schemes have a more generous approach to benefit design because they are not subject to competitive pressures and the risk of anti-selection (McLeod & Ramjee, 2007). They thus spend proportionately more on day-to-day benefits and chronic benefits than open schemes. They also spend less on managed care services (Council for Medical Schemes, 2007).

The market share of open schemes grew between 2000 and 2005, from 69.49% of beneficiaries to 71.76% of beneficiaries (Council for Medical Schemes, 2001, 2006a). This trend was arrested in 2006 with the rapid growth of the Government Employees Medical Scheme (GEMS), a restricted membership scheme for public sector workers (Council for Medical Schemes, 2007). The open scheme share of expenditure, and hence their influence on the mix of goods and services purchased, increased more than their market share over the period (Council for Medical Schemes, 2001, 2006a).

3.3. Benefit options offered by schemes

Each medical scheme may offer more than one product, referred to as 'benefit options', as long as each option covers a statutory minimum package, called the Prescribed Minimum Benefits (PMBs) (Republic of South Africa, 1998). Each option is required to be self-supporting, both financially and in terms of membership. Both the principal member and his/her dependants are required to belong to the same benefit option, and movement between options (referred to as option changes) may only take place once a year. Contributions vary between individual benefit options and are generally fixed for a one-year period, typically a calendar year.

The overall mix of goods and services purchased by the industry will depend on the range of benefit options offered by schemes and the options selected by the members of those schemes.

On average open schemes offer more options per scheme than restricted schemes; 5.4 as opposed to 2.1 (Council for Medical Schemes, 2009a). In part this is because open schemes tend to be bigger, with 3.63 times as many beneficiaries per scheme (Council for Medical Schemes, 2009a). Open schemes attempt to meet a wide spectrum of consumer needs by offering a range of benefit options. Between 2003 and 2008 the

number of options per scheme increased for both open schemes and restricted membership schemes (Council for Medical Schemes, 2004, 2009a). Data on the number of options offered by schemes are not available in the Council annual reports prior to 2003.

When members move between options, they tend to “buy down” from more expensive options to cheaper options (Joseph, 2006). This is in response to above-inflation contribution increases and the resultant affordability constraints (McLeod & Ramjee, 2007). This downward migration is also made possible because a high proportion of benefits are common across all options, as a consequence of the PMBs (Fish, et al., 2006). Over time this trend of downward migration can be expected to result in expenditure being more concentrated on the PMBs.

Schemes may also experience anti-selective “buy up” behaviour where members purchase more comprehensive cover as their medical needs increase over time - to the extent that this occurs it would have the opposite effect.

3.4. The legislative and regulatory environment

3.4.1. Prescribed Minimum Benefits

The most significant legislative effect on the purchasing patterns of medical schemes is the requirement for all options to cover at least the PMBs, which are a legislated package of benefits that schemes are required to cover in full, without co-payments or financial limits. The PMBs currently include cover for emergency care, 270 diagnosis-treatment pairs and 25 Chronic Disease List (CDL) conditions, but the package has been under review since 2008 (Council for Medical Schemes, 2009c). The diagnosis-treatment pairs were introduced from 1 January 2000, and care is primarily hospital-based. The emergency medical

conditions were clarified from 1 January 2003. Cover for the CDL conditions were implemented on 1 January 2004 and include diagnosis, treatment and chronic medication according to therapeutic algorithms (McLeod & Ramjee, 2007).

The introduction and subsequent extension of the PMBs had a significant impact on benefits offered by schemes. In particular, the introduction of the CDL forced schemes to introduce chronic benefits on options that previously offered no such benefits. At the same time, in order for schemes to manage their expenditure, coverage was reduced on many of the options that had previously provided cover in excess of the CDL. The CDL also encourages a more disease-based benefit design than a treatment-based benefit design (Fish, et al., 2006).

3.4.2. Underwriting limitations

The medical schemes environment is characterised by the key social solidarity principles of open enrolment⁵ and community rating. Membership is voluntary and schemes have limited protection against anti-selection, with the Medical Schemes Act only allowing for the imposition of waiting periods and late-joiner penalties, and only under a limited set of circumstances. The regulatory environment influences the population covered by medical schemes, discussed further in Section 3.6.

3.4.3. Variable benefits within a single option

In May 2005, a directive was sent by the Council for Medical Schemes to the Principal Officers of medical schemes indicating that schemes could no longer offer variable day-to-day benefits within a single benefit option

⁵ Open schemes have to accept anyone who wants to become a member at standard rates (McLeod & Ramjee, 2007).

(Council for Medical Schemes, 2006a). This had the effect of reducing the variation in benefits within an option and forced schemes to re-consider their benefit design.

3.4.4. Medical savings accounts

Medical scheme contributions are made up of risk contributions and savings account contributions. The risk contributions purchase the member (and his or her beneficiaries) insurance cover as part of a risk pool. They include loadings for non-medical expenditure (e.g. administration and broker commission). Savings contributions accrue in their entirety to a personal savings account for each member (i.e. there is no risk pooling). Any unused amount in a medical savings account at the end of a year can be rolled over to the following year, unlike risk benefits which are forfeited if not used.

The 2005 directive prohibiting variable day-to-day benefits also stopped schemes from offering variable medical savings accounts (Council for Medical Schemes, 2006a), thereby reducing the flexibility and consumer appeal of medical savings accounts.

Changes were made to the tax treatment of medical scheme contributions in March 2006. Whilst medical scheme contributions continue to be tax-deductible, a rand-cap on the amount that can be deducted was introduced. This had the effect of further reducing the appeal of medical savings accounts, as in most cases savings contributions were above the cap.

From 2005 to 2008 savings contributions as a percentage of gross contributions declined from 11.66% to 9.34% (Council for Medical Schemes, 2006a, 2009a). This decline in the use of medical savings accounts may result in increased coverage of day-to-day benefits from risk benefits, but this remains to be seen.

3.4.5. Non-medical expenditure

In recent years, the regulatory pressure on schemes to contain non-medical expenditure has increased. At the same time increased regulatory demands on medical scheme administrators have driven up the costs of scheme administration, for example, administrators now need to capture diagnosis codes and report on clinical information in a more sophisticated manner (McLeod & Ramjee, 2007).

This increased administrative complexity, together with the move toward real-time claims processing has resulted in a move away from self-administration to the use of third-party administrators (with consequent higher administrative fees) and increased concentration in the administrator market. (McLeod & Ramjee, 2007)

Following the publication of a report in 2001 revealing reinsurance abuses (McLeod, Slattery, & van den Heever, 2001), the Council intervened to severely limit the use of reinsurance by medical schemes. Changes to the process for applying for approval of reinsurance contracts were introduced in the Medical Schemes Amendment Act 2001. Reinsurance guidelines were published by the Council in 2002 (Council for Medical Schemes, 2003a).

The effect of the decline in reinsurance can be seen in the reduction of the 'other' category of non-medical expenditure (Figure 3.3).

3.4.6. Medicines and Related Substances Amendment Act and related regulations

Regulatory changes to pharmaceutical pricing (see section 4.1 for more detail) in 2004 removed perverse incentives for providers to prescribe particular pharmaceutical products (Republic of South Africa, 2004b). This impacted on the mix of products prescribed. The Amended Act also makes

provision for generic substitution in that pharmacists are compelled to inform patients of the benefits of generic substitution. The policy objective is for the pharmacist to substitute a cheaper generic product instead of an original product with the understanding and consent of the patient, unless the prescribing doctor indicates that the original product must not be substituted (Department of Health, 1996). Similar product substitution laws in the United States in the 1980s contributed to the rise in generic use experienced (Cook, 1998).

The move from percentage mark-ups on pharmaceutical products to a dispensing fee (discussed in more detail in Section 4.1) also encourages the dispensing of lower cost products, further increasing generic substitution.

The Amendment Act introduced the requirement for doctors to obtain a license to dispense medicine. This had the effect of reducing the proportion of claims for medicines coming from doctors (Lahey, 2006). Although the majority of medicines purchased by medical scheme members are dispensed by pharmacists, medicines are also dispensed by other providers such as general practitioners, medical specialists and hospitals. According to data on the private sector collected by Medicsor (2006) significant differences in dispensing patterns exist between categories of providers. Differences are reflected in the mix of products, the average cost per item and the level of generic utilisation.

3.5. Mechanisms for rationing benefits

The term rationing refers to the allocation of healthcare resources as a response to limited availability. Demand-side rationing acts to limit patient demand for healthcare services, typically withholding interventions from some individuals. Supply-side rationing is focussed on aligning the provider's incentives with the funder, usually through reimbursement mechanisms (Econex, 2010).

Both demand-side and supply-side rationing mechanisms will affect the mix of goods and services paid for by a medical scheme. Some examples of demand-side rationing in the South African environment are provided to illustrate the possible effect of rationing mechanisms on the composition of the basket.

Pre-authorisation requires clinical approval from the medical scheme before benefits may be accessed, and may be for a single clinical event or for ongoing access to particular benefits. Examples of pre-authorisation for single clinical events include admission into hospital and access to expensive technology, such as MRI scans. This will have the effect of reducing the number of events paid out of scheme benefits, and in particular will reduce the number of discretionary events.

Pre-authorisation for ongoing access typically involves registration on a benefit management programme. Common examples include chronic benefit management programmes and HIV benefit management programmes. In order to register beneficiaries will have to meet certain clinical criteria. Chronic benefit management programmes aim to influence drug utilisation (and thus the mix of products purchased) by reviewing the appropriateness and cost-effectiveness of each patient's drug regimen. They will also seek to eliminate drug interactions and duplications where these exist (Mediscor, 2009).

The existence of benefit management programmes may reduce the incidence of certain claims. For example, an effective HIV benefit management programme may reduce the number of Aids related hospital admissions.

Schemes may also ration benefits by shifting some of the expenditure to members. Examples of cost-sharing mechanisms include levies, deductibles and co-payments. Medical savings accounts are another form of member self-funding. In the South African context, medical savings accounts are used to fund day-to-day benefits, effectively shifting these components of expenditure outside of the risk pool.

Cost-sharing mechanisms affect benefit utilisation (and thus the basket of goods and services purchased) as they increase the price sensitivity of medical scheme beneficiaries (Mediscor, 2004). They also affect the price paid by the medical scheme, if one considers the net amount incurred by the scheme. This is discussed further in section 3.5.

As regards pharmaceutical benefits, Mediscor (2003, 2004, 2005) indicates that the extent of member self-funding (measured as the patient pay per item) increased significantly from 2002 to 2003, but subsequently declined from 2003 to 2004 and from 2004 to 2005. Changes in self-funding over time will influence the mix of products, particularly if the level of self-funding varies between different categories of benefits. For example, Fish *et al.* (2006) found that the level of self-funding for non-CDL conditions was much higher than the level of self-funding for CDL conditions in 2004.

Levies are an example of cost-sharing for pharmaceutical products. A levy is a relatively small, flat monetary amount paid at the point of service, usually per item claimed. Levies are used in pharmaceutical benefit design to limit the number of prescriptions claimed for (i.e. affects frequency of claims) but do not influence the choice of product (Mediscor, 2004). Levies do not decrease the amount payable by the scheme: they are an additional charge to the member.

In contrast, a deductible requires the member to pay the first part of a claim, up to a pre-determined amount, and decreases the amount payable by the scheme. The use of deductibles has increased in recent years, typically targeted at reducing utilisation of benefits for discretionary events or expensive technology (McLeod & Ramjee, 2007).

The term co-payment is a misnomer in the South African medical scheme context and typically refers to either a form of co-insurance where the member pays a percentage of each claim or a Rand amount the member is required to pay. Co-payments are frequently used in pharmaceutical benefit design and may be for all pharmaceutical items paid out of a particular benefit (e.g. all acute medicines) or may be as a

function of reference pricing or drug formularies (explained below), that is, used to influence benefit utilisation in a more targeted manner (Mediscor, 2004). Co-payments may also arise if members do not make use of a preferred provider or, in the case of PMB benefits, if they make voluntary use of a non-designated service provider.

There are three additional mechanisms used to ration pharmaceutical benefits: drug formularies, reference pricing and chronic disease lists.

A drug formulary is a list of reimbursable drugs and has the effect of limiting coverage to those products listed, and is often used to encourage the use of generic products. The use of drug formularies can decrease the utilisation of particular drugs if they are excluded from the formulary and increase the utilisation of others that are included (Mediscor, 2009).

The application of reference pricing requires that drugs be categorised into therapeutic classes, with a reference drug selected in each class. The maximum price to be reimbursed is then set based on this reference drug, with the consumer having to pay the difference in price if a more expensive drug is used (Mediscor, 2009). This has an effect on the mix of items purchased, as consumers can be expected to alter their purchasing patterns to avoid having to pay in the price difference (Doonan, 2001).

The use of chronic disease lists (where members are only covered for a specified list of diseases) also impacts on item coverage. The introduction of the CDL has impacted on the ability schemes have to ration chronic benefits using co-payments and financial limits, and has thus created a shift in the rationing mechanisms used. Fish *et al.* (2006) found that the use of formularies increased from 2003 to 2004 whilst the number of diseases covered outside of the CDL declined over the same period.

3.6. Characteristics of the insured population

The characteristics of the insured population will affect the extent to which available benefits are utilised, and hence the mix of goods and services purchased by the scheme. The demands of the insured population may also drive benefit design in a competitive environment.

The size of population covered by medical schemes has been relatively stagnant over the period covered in this research, with an increase in coverage from 2005 onwards (McLeod & Ramjee, 2007). Little is known about the extent of turnover in the medical scheme population as there is no central database of members. The recent increase in coverage is the result of previously uncovered State employees joining GEMS. These beneficiaries are likely to have different utilisation patterns to those already in the system due to their lower levels of historical access to medical care.

The profile of the insured population is influenced by the voluntary nature of the environment. Community-rated contributions combined with increasing affordability pressures will inevitably result in a shift in the risk profile of beneficiaries over time, with the young and healthy being most likely to remain outside of the system. This is evident by the changing age profile of beneficiaries over the period, with a lower proportion of children and young adults currently being covered (McLeod & Ramjee, 2007).

The voluntary nature of the environment may also lead to anti-selective behaviour. There is evidence of women entering the medical scheme environment in order to gain access to maternity benefits, with a consequent increase in the number of maternity cases paid for by schemes (McLeod & Ramjee, 2007).

Changes in the prevalence of certain medical conditions within the covered population can also impact on utilisation patterns.

3.7. The availability of goods and services

The goods and services available to medical schemes will change over time. The following discussion focuses on pharmaceutical products, but similar issues arise with advances in medical equipment (e.g. diagnostic technology), improvements in the way in which medical procedures are performed (e.g. laparoscopic procedures) and numerous other aspects of medical practice.

The pharmaceutical product market in particular is dynamic in nature, with significant levels of technological change (Berndt, *et al.*, 1992). Drug innovation occurs both in the treatment of previously untreated or ineffectively treated conditions and in improvements to current treatments, with spending increases attributable to increased utilisation and to new treatments being more expensive than existing treatments (Doonan, 2001; Mediscor, 2003).

Medical research can also influence the consumption of an existing product by providing or refuting clinical evidence for the use of the product. For example, evidence may emerge which broadens the indications for use of a drug or alters the recommended duration of use. An example of this is the recent evidence that has emerged supporting the long-term use of Lacosamide, an epilepsy drug (Chung, 2010). Also, advances in information technology have increased the speed of the dissemination and implementation of clinical evidence. An example of this is the British Medical Journal publication of a clinical evidence website⁶ with RSS news feeds.

The withdrawal of a drug can also impact on the basket dramatically. For example, prior to its worldwide withdrawal on 30 September 2004, Vioxx™ was the third highest ranking product in the Mediscor report (2004, 2005).

⁶ <http://clinicalevidence.bmj.com/ceweb/index.jsp>

Internationally, strong marketing drives undertaken by pharmaceutical companies have also been shown to impact on utilisation (Doonan, 2001). A local example is the product Plavix™ which experienced an increase in utilisation from 2003 to 2004 despite being available in South Africa since 2000. Mediscor (2005) attributes this increase to a stronger marketing drive.

The introduction of generic equivalents to the market impacts significantly both on price and utilisation patterns. The Mediscor reports provide a number of measures of how generic utilisation has increased in South African Medical Schemes, for example, the number of generic products in their top 50 products has increased dramatically over time. In 2002 there were no generic products in the top 50, in 2003 there was one, in 2004 six, in 2005 nine and in 2008 fifteen (Mediscor, 2003, 2004, 2005, 2006, 2009). This further supports the need to regularly update the basket in order to prevent under-weighting generic items.

Medical scheme expenditure on generic items increased from 25.3% in 2006 to 29.3% in 2008, whilst the volume of items dispensed increased from 45.5% in 2006 to 47.4% in 2008 (Mediscor, 2009). A number of possible reasons may be advanced for the increase in generic utilisation. These include the introduction of more generic alternatives to the South African market, the role of reference pricing and formularies in promoting the use of generics and greater awareness of generic products amongst consumers (Mediscor, 2005, 2006).

The Mediscor Medicine Review reflects substantially lower average expenditure per item for generics than for original products with valid patents and those with expired patents. These figures can be seen in Table 3.1.

Table 3.1 Average expenditure per item 2006-2008 (branded and generic)

Average expenditure per item (in Rands)	2006	2007	2008
Original product with valid patent	145	165	184
Original product with expired patent	130	134	133
Generic equivalents	56	67	77

Source: Mediscor (2009)

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Chapter 4

Literature review - factors influencing the determination of prices

Many of the factors influencing the composition of the basket of goods and services purchased by medical schemes also affect the prices of them. Examples include mechanisms for sharing costs with members of medical schemes, the introduction of generic pharmaceutical products to the market and reference pricing for pharmaceutical products.

This chapter focuses on those factors affecting the prices experienced by medical schemes that have not already been discussed in Chapter 4.

4.1. Pharmaceutical pricing regulations

Since the beginning of 2004, significant changes to pharmaceutical pricing have occurred in the South African environment. These changes highlight the need for a representative pharmaceutical price index which would allow the impact of such regulatory change on the prices faced by medical schemes to be measured.

The changes to the pricing system were brought about through amendments to the Medicines and Related Substances Act (Act no 101 of 1965), with the aim of increasing the affordability of medicines and ensuring a more transparent pricing process. The Amendment Act was signed into law in January 2003 but aspects of the changes to the pricing system were challenged in court causing numerous delays in implementation (Forman, Pillay, & Sait, 2004).

These changes to pricing structure are critical to consider in constructing a pharmaceutical price index as they affect the relationship

between transaction prices and list prices, the variation in price by dispensing provider type (i.e. pharmacist, doctor or hospital), the variation in price by pack size and the pattern of price increases over time. The extent of the impact on medicine price trends will depend on how effectively the legislation is implemented and monitored.

Prior to the regulatory change the transaction price could vary considerably from the list price due to the existence of “a complex system of bonuses, rebates and other incentive schemes” (Mediscor, 2005, p.45). Larger suppliers of medicines could obtain medicines at a price significantly below the list price, and the price of a pharmaceutical product could thus vary between providers. Similarly, medical schemes were able to obtain bulk discounts causing prices to vary between medical scheme and non-medical scheme members (Mediscor, 2005).

The enabling regulations (Republic of South Africa, 2004a), which commence in May 2004, aimed to introduce a transparent pricing system by:

1. preventing perverse incentives to increase the sales of particular products, for example, by providing free samples;
2. disallowing discounting, including bulk discounts, trade discounts, settlement discounts and formulary listing payments (where payments are made to ensure that a particular medicine is included in a drug formulary);
3. requiring the manufacturer (or the importer) of a medicine to establish a Single Exit Price (SEP) which includes all costs associated with the manufacture and sale of the medicine, including a logistics fee and VAT, at which a particular medicine has to be sold; and
4. defining a maximum Professional Fee (referred to as a dispensing fee) to be charged by a licensed dispenser of medicines to cover the costs of dispensing (as opposed to marking up the price).

The total price paid by patients for medicines was envisioned to be the Single Exit Price plus a maximum dispensing fee, that is, variations in

prices between providers should be limited to differences in the dispensing fees charged. In addition, under the SEP system there is no variation in price according to pack size, that is, the price per tablet for a pack of 100 tablets and a pack of 10 tablets is the same. The Department of Health regulates the maximum increase in SEP each year (via a pricing committee). This is likely to result in a change in the pattern of price increases over time, with increases likely to be concentrated in the time period following the publication of the allowable increase and not spread throughout the year. The effect of the pricing regulations on price trends will depend on the extent of industry compliance and the effectiveness of monitoring procedures put in place by the regulator. Legal challenges to the medicine pricing regulations faced in 2004 and 2005 resulted in pharmacists charging customers and medical schemes an administration fee to compensate for a loss in earnings under the new medicine pricing laws (Mediscor, 2005). As the new regulations did not state that no other fee, besides the dispensing fee, could be charged, pharmacists took advantage of this loophole despite the disapproval of the Department of Health, resulting in further variation between providers. Amended regulations, published in December 2006, made the charging of administration fees illegal (Republic of South Africa, 2006).

Due to legal challenges to the dispensing fee regulations there have been periods when retail pharmacists could charge any “reasonable” dispensing fee, taking into account that charging an excessive fee would be regarded as misconduct under the Pharmacy Act.

The Medicines Pricing Committee have proposed an International Benchmarking of pharmaceutical prices. The intention of doing so would be to reduce the price of pharmaceuticals in South Africa to the lowest of a defined basket of countries (Australia, Canada, New Zealand and Spain) (Medicines Pricing Committee, n.d.). Once implemented, this policy can be expected to impact materially on prices. Even in the absence of International Benchmarking, pharmaceutical pricing is strongly influenced

by global pricing decisions which in turn are influenced by regulatory regimes in other countries (Bond, 1999).

4.2. The National Health Reference Price List (NHRPL)

Prior to 2004, fee-for-service tariffs were negotiated centrally between schemes (represented by the Board of Healthcare Funders) and representative bodies of providers. These tariff schedules applied to a wide range of medical disciplines, including general practitioners, medical specialists and dental practitioners. Hospital tariffs were negotiated between the Board of Healthcare Funders and the Hospital Association of South Africa, and there was no negotiation around pharmaceutical prices.

The central negotiation of tariffs was deemed anti-competitive by the Competition Commission in favour of individual negotiations between schemes and providers. From 2004 the Council published a NHRPL to aid the negotiation between schemes and providers. The NHRPL was not intended to be a set of medical scheme tariffs, but rather a guide for both schemes, in determining reimbursement levels, and providers, in price setting (Council for Medical Schemes, 2006b).

As with the previous tariff schedules the NHRPL is a set of procedure codes. Each code published in the NHRPL has a unit value allocated to it, to allow schemes to determine the relative value of each procedure. The NHRPL values are meant to be determined using a cost-based approach (with submissions invited from providers), with the idea being that more efficient providers can charge less than the NHRPL whilst less efficient providers will be forced to charge more (Council for Medical Schemes, 2006c).

In most cases the relative values for codes did not change in the transition from the tariffs negotiated by the Board of Healthcare Funders,

and in practice the majority of schemes reimburse providers at NHRPL (or a multiple thereof) and there is little individual negotiation that occurs. This is not surprising given that there are more than 12 000 doctors operating in the private sector (Econex, 2009) and 131 medical schemes (Council for Medical Schemes, 2009a).

It should also be noted that medical scheme members may still incur an out-of-pocket payment as practitioners are not obliged to charge the NHRPL rate. The price to the consumer and the price to the medical scheme may thus vary considerably. Until November 2008, the Health Professions Council of South Africa (HPCSA) also published a price list (referred to as the HPCSA ethical tariff). These tariffs were meant to be used to determine whether a practitioner was overcharging, and as such represented a price ceiling (Republic of South Africa, 1974). Historically the ethical tariff has been roughly three times higher than the NHRPL (Peters-Scheepers, 2008).

The Department of Health (DoH) took over responsibility for the NHRPL from the Council from 2007. The NHRPL relative values were not re-calculated in 2007 and 2008; in both years the price list was simply increased by an inflation linked percentage: 4.9% from 2006 to 2007 (Council for Medical Schemes, 2006c) and 5.4% from 2007 to 2008 (Healthman, 2009). The 2009 price list was subject to much controversy, primarily due to high levels of consumer price inflation in 2008. An increase of 8.7% from 2008 to 2009 was initially published (Department of Health, 2008), but this was later increased to 10.7%. The 2009 NHRPL is still subject to court action and, hence, the 2010 schedule cannot be determined until 2009 is finalised. In the interim the Council for Medical Schemes has published a notice indicating an increase of 7.9% (Council for Medical Schemes, 2009b).

The linking of NHRPL increases to the CPI constitutes a major departure from the tariff increases in excess of the CPI achieved under central negotiation. This can be seen in the results of the GP and specialist components of the Da Silva index (Da Silva, 2007).

4.3. Dynamics in the health care provider market

To the extent that medical schemes do negotiate prices with providers, the prices negotiated are affected by the relative bargaining power of the entities involved. Provider bargaining power is enhanced by shortages in supply in key areas, most notably the shortage in the numbers of medical specialists (Board of Healthcare Funders, 2006). In the private hospital market price negotiation is affected by the concentration of hospital ownership by three large hospital groups (Matsebula & Willie, 2007). To some extent this is counterbalanced by the high levels of concentration in the medical scheme administrator market where the six largest administrators provide services for 73.9% of medical scheme beneficiaries (Council for Medical Schemes, 2008b). Medical scheme administrators typically negotiate with providers on behalf of the schemes under their administration (Da Costa, 2008).

4.4. The effect of rationing mechanisms on price

Cost sharing with members was discussed in detail in section 3.5. Depending on the form that cost sharing takes, the price paid by the medical scheme may or may not be affected. Deductibles, co-payments and co-insurance arrangements all reduce the net amount incurred by the scheme, whereas levies do not affect the scheme's liability.

Both drug formularies and reference pricing may force price competition amongst pharmaceutical companies by driving utilisation patterns. With drug formularies, companies may compete to be included on the formulary. With reference pricing, pharmaceutical companies may reduce their prices to below the reference pricing level to increase sales of their product.

Medical schemes may permit members to access drugs not on the formulary or above the applicable reference price. In these cases members will need to pay the price difference (i.e. a co-payment) (Mediscor, 2009). The price from the medical scheme perspective is thus pegged at the level of the formulary item, or the relevant reference price.

The South African health care market has historically been dominated by fee-for-service reimbursement (Broomberg & Price, 1990). Here the provider charges for each item used or service performed, and there is consequently a price available for each item. There has been an increase in the use of alternative reimbursement, where some of the risk is transferred to the provider and the price is more aggregated.

Capitation arrangements are typically found in the arena of primary care benefits in South Africa and cover general practitioner consultations, basic optometry, basic radiology, basic pathology, acute medication and basic dental benefits (Ranchod, McLeod, & Adams, 2001). There may also be some chronic medication benefits (Fish, et al., 2006). The price from the medical scheme perspective is a flat amount per beneficiary per month, and covers multiple categories of expenditure.

Alternative reimbursement arrangements can also be found in the hospital environment (Netcare Limited, 2008). *Per diem* arrangements and fixed-fee contracts are the most common (Ruff, 2001). Again the price from a medical scheme perspective will be more aggregated than in a fee-for-service environment.

Alternative reimbursement arrangements alter the profit incentives faced by medical providers and may act to limit price increases over time if providers can enhance profitability by increasing efficiency. Newhouse (2001) observes this effect in the US over the period 1993 to 1997, the key period of implementation of alternative reimbursement in that environment.

4.5. Prescribed Minimum Benefits

Schemes are required to cover the PMBs at cost. They are thus not allowed to impose a maximum tariff, unless that tariff has been negotiated with the provider concerned. This means, that unless a scheme has a contract with a provider, the scheme will have to reimburse the provider at the price charged.

Thus, although the scheme may reimburse providers at NHRPL, if a claim is a PMB and the provider charges more than NHRPL they will be obliged to pay the higher amount. For the most part, this does not affect hospital claims as schemes tend to have contracts in place with private hospitals.

The existence of PMBs, and the proportion of benefits that are PMBs, thus impacts on the prices encountered by medical schemes.

Chapter 5

Methodology

In applying the theory of index construction to medical scheme prices, a number of methodological choices need to be made. As a starting point the index needs to be defined precisely and sources of data need to be identified. Decisions are required regarding the choice of reference period, the frequency of publication, the weighting structure of the index, the units of service for each component of the index, the elementary aggregation of individual items and the sampling of items to include in the index.

5.1. Defining the index

The aim of the price index is to measure the change in the prices of goods and services purchased or acquired by South African medical schemes, including both medical and non-medical goods and services. The goods and services are used either directly or indirectly to satisfy the demands of medical scheme members.

The index will reflect the experiences of both open and restricted membership medical schemes. Bargaining Council schemes will not be included as they differ substantially from registered schemes, and their inclusion in the index would make both data collection and index construction more complex, and distort the index without making it applicable to these schemes.

Expenditure from medical savings accounts will also not be included in the construction of the index, both in terms of weights and price changes, because the expenditure from these accounts is not considered to be

medical scheme expenditure. Medical savings accounts are similar to personal bank accounts in that the funds in a savings account belong to the member and do not form part of scheme assets.

The consumer price index has geographically-determined sub-indices. Currently there are insufficient data available to support such a split in the medical scheme context. Whilst there are rural/urban differences in the demand for goods and services, the majority of medical scheme members are located in urban areas. The existence of the Discovery Coastal Core option points to the possibility of differences in regional experience but further work is required to clarify the extent of these differences.

5.2. Data

5.2.1. Sources of data

Data are required both for determining the weights of the index and for calculating changes in price. In a consumer price index, data for the weighting structure are typically obtained from a survey of household expenditure whilst price data are collected from outlets (ILO, *et al.*, 2004). For a medical scheme index, data are required on the expenditure patterns of medical schemes. High-level summarised data on the expenditure patterns of medical schemes can be obtained from the Council for Medical Schemes Annual Reports, which are in turn based on annual returns submitted by schemes to the regulator. This source of data has the advantage of being for the medical scheme industry as a whole, obviating the need for sampling from the population of all medical schemes. The data are also audited, and thus reliable. There are, however, a number of disadvantages: there is no detailed information available, there is a lag in the availability of the data (typically data from one year are only available by August of the following year) and it is

impossible to allow for differences in definition or coding of data by the individual schemes.

More detailed data on expenditure patterns are obtainable directly from medical schemes. Medical scheme data are typically managed and controlled by the administrator of the scheme, although legally the data are owned by the scheme. Medical scheme data could be obtained directly from the scheme administrators provided permission has been obtained from the scheme itself. Whilst there is considerable overlap in the data managed by different administrators, there may be differences in the fields included, data definitions, the grouping of data and in overall data quality.

Medical scheme administrators store large quantities of detailed data relating both to the contributions collected and claims paid. Historical data may also be available from particular administrators, enabling the back-testing of any indices constructed. Medical scheme data are typically available in a usable format as the data are used extensively for other purposes, for example, pricing and risk management. The ease of use of medical scheme data is greatly enhanced by the broad and standardised use of “coding” (discussed further in 5.2.2).

Obtaining data from medical scheme administrators and not from schemes directly has the practical advantage of there being fewer parties from which to obtain data. The administrator market is highly concentrated, with the six largest administrators providing services for 73.9% of medical scheme beneficiaries (Council for Medical Schemes, 2008b). It is proposed that sampling be done purposively, with data collected in so-called clusters from these six medical scheme administrators.

5.2.1. Data quality

There is little information available on the quality of medical scheme data, and the extent to which quality varies between administrators (and thus schemes).

A 2002 survey of the medical scheme industry indicated problems with both the type of data collected by schemes and the quality thereof, including a lack of data standardisation (Council for Medical Schemes, 2003c). Numerous developments since then, such as the introduction of compulsory diagnosis coding and the process requiring schemes to submit mock Risk Equalisation Fund (REF) returns to the Council, are likely to have led to an increase in the standard of data kept. The Council has been assessing the quality of medical scheme REF return submissions and whilst these data are not directly comparable to the data needed for the construction of an index, the Council assessment does provide some indication of data accuracy, particularly relating to the clinical coding of the data. For the 2006 submissions, data in respect of 72% of medical scheme beneficiaries was rated as being of “fair” quality (Council for Medical Schemes, 2007). On the other hand, the Council found that the quality of data differs between medical scheme administrators (Council for Medical Schemes, 2008c).

Additional sources of data include managed care companies and medicine clearing houses (such as Mediscor and Medikredit). Data from these sources may be useful for checking the data from medical scheme administrators as well as to provide supplementary information. For example, data from medicine clearing houses could be used to supplement data on medicine pack sizes. It may be necessary to obtain data in respect of capitated benefits from the relevant managed care companies. Fish *et al.* (2006) found that capitated benefits are typically not provided on a “look-through” basis, that is, the scheme is not able to identify separately the various categories of costs.

Were data for the construction of an index to be collected on an industry-wide basis, a shadow period during which data quality can be assessed may be desirable. During the REF shadow return process data quality was found to improve significantly: in a 6 month period the proportion of beneficiaries with data rated as being “poor” declined from 25% to just 7% (Council for Medical Schemes, 2007). A shadow period allows feedback to the scheme administrators should system changes be necessary. The support of the regulator in such a data collection process is also desirable as such a process would need to be mandated by law.

5.2.2. Standardised coding systems used by South African medical schemes

Extensive standardised coding is applied by the medical scheme industry. The use of codes has the advantage of summarising large amounts of data in a single code, thereby reducing the size of datasets. It also ensures that information is presented consistently, and enhances the capability to consolidate data from different sources (Council for Medical Schemes, 2003c). Standard codes exist for pharmaceutical products, diagnoses, procedures and fee-for-service billing.

Pharmaceutical products are uniquely identified in medical scheme data using the National Pharmaceutical Product Interface (NAPPI) coding system. This system is widely used in the private health sector, whilst the public sector makes use of the National Stock Number (NSN) system. The NAPPI system is maintained and published by MediKredit, a private sector medicine clearing house, and is freely available. Given that the coding system is not a publicly available official coding system it is of uncertain quality and bias.

A six-digit NAPPI code provides information on the manufacturer of the product, the product name, the strength and the formulation (tablet,

syrup, capsule etc). The additional three digits in a nine-digit NAPPI code provide information on the pack size. (MediKredit, 2006)

The *International Statistical Classification of Diseases and Related Health Problems* (ICD) system of diagnosis coding was initially developed to aid the collection of mortality and morbidity statistics and has become the international standard for diagnosis classification. The World Health Organisation is responsible for maintaining and updating the coding system - the ICD-10 is the tenth revision of the ICD coding system and has been in use since 1994. (World Health Organisation, n.d.)

The ICD-10 system is a hierarchical, alpha-numeric system that translates the clinical diagnosis of an illness, injury or condition into a code, and has been accepted as the standard to be used in both the public and private sectors in South Africa (Council for Medical Schemes, 2003c). In the private sector, diagnosis coding has been used extensively by managed care organisations for a long time in order to improve the clinical quality of their data; for example, a hospital pre-authorisation usually has a diagnosis code to facilitate communication between the managed care organisation and the hospital. However, ICD-10 coding only became compulsory for all medical providers as of 1 July 2006: the National Task Team for ICD-10 implementation was established in January 2004 to oversee this process, and a phased-in approach for providers began on 1 July 2005 (National Task Team On ICD-10 Implementation, 2006). There are numerous problems with diagnosis coding including the subjective nature of diagnoses, the need for highly skilled personnel to interpret clinical information into codes and the scope for code manipulation.

The Current Procedural Terminology (CPT) system is the standard procedure coding system used in the South African private sector, the local version of which is licensed by the South African Medical Association (SAMA) and referred to as the Complete CPT for South Africa (CCSA) (Actuarial & Insurance Solutions at Deloitte & Ferreira, 2007). CPT codes are 5-digit codes and there are approximately 7 000 codes for medical, surgical and diagnostic services and procedures (Council for Medical

Schemes, 2003c). The CPT system was developed for use by doctors, but is used by both doctors and hospitals in South Africa, with the system mainly used to code in-hospital services in South Africa (Actuarial & Insurance Solutions at Deloitte & Ferreira, 2007). The codes are used to describe hospital admissions and are not used for billing purposes.

The NHRPL is a set of fee-for-services reference prices used for billing by private health practitioners in South Africa. The primary purpose of the NHRPL coding system is for billing and not to provide descriptive information (Actuarial & Insurance Solutions at Deloitte & Ferreira, 2007). The NHRPL codes play an essential role in the construction of the price index as they link directly with price data. However, because the NHRPL coding system is not a hierarchical coding system (Actuarial & Insurance Solutions at Deloitte & Ferreira, 2007), there is limited scope to use it as part of the weighting structure of the index.

The NHRPL system allows for code modifiers to be used in cases where the circumstances of the medical event support the charging of a higher fee. For example, where surgery is performed on newborn babies, surgeons may charge the standard fee for the procedure plus an additional 50%. It is proposed that all claims with modifiers be excluded from the data for the purpose of calculating transaction prices. Further work needs to be done to evaluate the extent to which modifiers are used and the accuracy and consistency of their use. A potential disadvantage of excluding modifiers is that if the extent of use of modifiers changes over time an element of price change would not be captured by the index. A fee-for-service environment may encourage the use of modifiers and the index would thus understate true price changes.

Other propriety coding systems may also be used, for example, PMB claim identifiers, Diagnosis-Related Groupers (DRGs) and episode groupers.

5.3. The weight reference period and frequency of publication

The reference period is the time period to which the estimated weights relate. The chosen period should cover a seasonal cycle, which in the case of medical schemes would be a calendar year. The demand for medical goods and services tends to vary over a calendar year, for reasons of climate, benefit availability and practical considerations (for example, doctors tend not to schedule elective procedures over the year-end holiday period). To eliminate seasonal biases in the basket it is suggested that the basket weights be based on annual data (allowing sufficient time for claims to be fully run off).

Whilst there are some items in the basket which experience annual price changes, for example administration fees and items that are priced according to the NHRPL, other items in the basket may experience price changes at any time during the year. An index reflecting monthly changes in prices is proposed, as this is in line with the publication of official statistics and significant price changes are unlikely to occur more frequently than monthly.

5.4. Classification of goods and services

The way in which goods and services are classified provides the weighting and aggregation structure of the index, as well as the scheme for stratifying products in the sampling frame. The range of sub-indices that can be published will also depend on how the index is structured.

Goods and services can be classified according to their purpose or according to product type (ILO, *et al.*, 2004). A hybrid is suggested here with a purpose-based classification at the highest levels, and a product-based classification at the lower levels. At the highest level it makes sense

to split the index into medical goods and services (where the purpose of expenditure is to meet the medical needs of medical scheme beneficiaries) and non-medical goods and services (where the purpose of expenditure is to enable functioning of the medical scheme itself).

A product-type approach is chosen for the lower levels of the index, as it closely reflects the economic reality of medical schemes, where price dynamics vary along product lines, for example, the occurrence of separate tariff negotiations for the various practitioner groups. If considered from the perspective of providing a stratification scheme for sampling, the suggested structure will minimise the within-stratum variance while at the same time maximising the between-stratum variance (ILO, *et al.*, 2004).

The major categories of expenditure outlined in the Council annual reports for medical goods and services are hospital, medical specialist, pharmaceutical, general practitioner, dental and other. For non-medical goods and services the major categories are administration, managed care and acquisition. The suggested categories offer the benefit of being unambiguously mutually exclusive, whilst still providing complete coverage of all products considered to be within the scope of the index.

This structure meets the needs of users of the index. For example, the medical categories largely reflect the benefit design structure of medical schemes, as well as the delineation of managed care programmes. The regulator and DoH will also be interested in groups of practitioners and the associated price dynamics (e.g. hospitals).

The problem with this approach is that there will be situations (with new products or bundles of existing products) where a neat fit into a category is not possible (ILO, *et al.*, 2004). An example would be capitation agreements where a range of goods and services (falling into different classes) are provided for a single fee. For now, capitation contracts make up a sufficiently small part of medical scheme expenditure to be categorised as “other” but in time it may become necessary to create a separate category.

All the goods and services purchased by medical schemes will need to be grouped and classified so that they can be aggregated for the compilation of sub-indices. Each claim, that is, each item of medical expenditure has a NAPPI code or a tariff code associated with it, as well as a practitioner code (reflecting the type of medical provider that submitted the claim). The non-medical expenditure is clearly split in medical scheme financial statements.

All pharmaceutical products (excluding surgical products) can be easily identified as each item has a NAPPI code associated with it. All items with a NAPPI code, other than those dispensed by a hospital, are classified as “pharmaceutical”. Items with a NAPPI code that are hospital-dispensed are classified as part of hospital expenditure in the Council annual reports. All non-pharmaceutical claims can be classified by the claiming provider type into hospital, medical specialist, GP, dental and other.

The pharmaceutical component of the index is based on pharmaceutical unit prices, for example, the price per Panado and not per pack of Panados. The difficulty with basing the index on unit prices is that, unfortunately, not all medical scheme administrators store 9-digit NAPPI codes or accurate pack size data. A potential solution to this problem is outlined in section 5.6.3.

The chosen unit of service for hospital expenditure is a hospital event because the definition of a hospital event is more likely to be consistent across medical schemes than the definition of a hospital day. The use of a hospital event as the unit of service also accommodates changes in tariff structures over time more easily than the use of a hospital day by making it easier to re-price an account. It is suggested that prices only be collected from private hospitals (as is done for the CPI) as billing data for public hospitals is highly problematic, and medical scheme expenditure in public hospitals remains low. Should public sector billing practices improve this component of medical scheme expenditure may increase, necessitating inclusion in the index.

The chosen unit of service for all other medical claims is the NHRPL tariff code. For all non-medical items it is proposed that expenditure be converted to a per-beneficiary figure. This is debatable given that some items (e.g. administration fees) are charged for on a per-member basis.

5.5. Choice of formula

The proposed formula takes the form of a price-relative index which, as discussed in section 2.4, allows more easily for the construction of sub-indices and for the analysis of price changes for individual items.

An annual weight reference period is proposed, and consequently, if we are to use any index formula using current weights, publication of the index would have to be delayed until after the end of each year. For example, the index number for February 2009 could only be published in early 2010 when the weights based on the complete 2009 year are available. Neither the Paasche formula nor any of the superlative formulae are recommended given the resultant delay in publication.

With a Laspeyres index the weight reference period is equal to the price reference period. This would necessitate calculating average prices over an annual period, where prices collected on a monthly basis would give a clearer pattern of price progression.

There are two choices of formulae where the weight reference period pre-dates the price reference period: the first is a Lowe index (where quantities are held constant) and the second is a Young index (where expenditure shares are held constant). For products and services with a high elasticity of substitution, a Lowe index will exceed a Laspeyres index which, in turn, will exceed a Paasche index (ILO, *et al.*, 2004). This substitution bias is less of a concern for medical schemes where the third-party-payer effect would reduce the elasticity of substitution. The relationship between a Lowe index and a Young index is less clear, but again would depend on substitution elasticity, because expenditure shares

are less likely to remain constant if substitution elasticity is high. Any concerns about substitution are also mitigated by updating weights more frequently (Griliches & Cockburn, 1994).

A Young index is selected, given that the high-level expenditure shares in the annual Council reports appear to remain relatively constant over short periods of time. The detailed formula for implementing this is given in Appendix A.

5.6. The weighting structure

Table 5.1 illustrates the proposed structure of the medical scheme index. Tier One (the highest tier), namely the split between medical and non-medical, and Tier Two, namely the split into the major categories of expenditure as per the Council reports, have been discussed already.

Table 5.1 Structure of tiers three and four of the index weighting structure

Tier One and Tier Two	Tier Three	Tier Four
1. Medical		
1.1. Hospital	Private acute hospitals only	Grouped into: day cases and in-patient; with in-patient cases grouped into medical, surgical and maternity cases
1.2. Medical Specialist	Grouped into specialties Only a sample of medical specialties For example: 1.2.1. Pathologist 1.2.2. Radiologist 1.2.3. Anaesthetist (A full list can be seen in Appendix A)	Grouped into consultations, procedures/ operations, equipment and other
1.3. Pharmaceutical	Pharmacy-dispensed only	Grouped into medicine schedule and the categories generic, original and branded
1.4. General Practitioner	No grouping	Grouped into consultations, procedures/ Operations, equipment and other
1.5. Dental	Dentists only	
1.6. Other	Grouped into the key practitioner types. For example: 1.6.1. Optometrist 1.6.2. Pharmacist 1.6.3. Physiotherapist (A full list can be seen in Appendix A)	
2. Non-Medical		
2.1. Administration fee	Grouped by administrator	Third-party administration fees only
2.2. Managed care fee	Grouped by managed care organisation	Fees for key managed care services
2.3. Brokerage fee	No grouping	No grouping

For the lower tiers the categories to be included have been limited to simplify the index and data collection. Statistics South Africa (2009), in the medical component of CPI, limits both the practitioner types and the items included in the basket.

In the hospital category, public hospitals are excluded and the index restricted to only cover acute care facilities (practice codes 57 and 58). The excluded categories include day facilities, mental health institutions and sub-acute facilities. Private acute care facilities made up 98.3% of medical scheme expenditure on hospitals in 2008 (Council for Medical Schemes, 2009a).

The South African hospital market is dominated by three large hospital groups, namely Life Healthcare, Netcare and Medi-Clinic, who operate more than three quarters of acute beds in the private sector (Matsebula & Willie, 2007). Each group makes up more than 20% of available private beds (Matsebula & Willie, 2007). In addition, the National Hospital Network (NHN) acts as a negotiating block for some of the independent hospitals.

Whilst there are also a large number of independent hospitals, it makes practical sense to limit the index to the three largest groups and NHN to simplify data validation. Medical schemes (or their administrators) negotiate separately with each hospital group and with NHN, and consequently the level of hospital prices as well as the tariff structures will differ between the groups.

Similarly tariff increases are negotiated separately for each medical speciality making it necessary to delineate the index along these lines. Expenditure is fairly concentrated with the top 12 specialities constituting 85% of expenditure in 2008 (Council for Medical Schemes, 2009a).

It is suggested that the pharmaceutical expenditure be confined to that which is pharmacy dispensed. This simplifies the calculation of dispensing fees which differ between doctors and pharmacists. Pharmacies dispensed 88.5% of pharmaceutical products in 2008 (Council for Medical Schemes, 2009a). Ideally separate indices should be created

for chronic and acute medication but doing so is complicated by differences in benefit design between schemes. The NAPPI code alone does not indicate whether a claim was paid from a chronic medication benefit or not, and the same drug can be considered either acute or chronic depending on the circumstances under which it was prescribed. Creating sub-indices along benefit lines would thus violate the principle of each item being unambiguously allocated to a category.

Dental expenditure is largely generated by dentists and not by dental specialists. It is thus proposed that the index be limited to dentists, as is done by Statistics South Africa (2009). The suggested weights for each category, as well as the estimated coverage of the index are given in Appendix A.

5.6.1. Updating the weights

It is proposed that the weights for the top tiers of the basket be updated less frequently than the lower tiers. The medical scheme sector is characterised by rapid change, and consequently, it is proposed that the weights for the lower tiers be updated on an annual basis. More frequent updates are not possible since weights are based on annual data.

The disadvantage of changing weights frequently is the resultant loss of comparability and consistency over time. To counterbalance this, it is suggested that the split between medical and non-medical expenditure and the split between broad categories of expenditure be based on data available in the Council annual reports, and only be updated every five years.

Keeping these weights constant does not allow for substitution between categories of expenditure in the periods before the weights are updated, but this is not problematic as substitution between these high level categories is unlikely. The problem of expenditure shifting between categories of expenditure, and the risk of the resultant savings not being

captured, is far more acute at the lower tiers of the index structure. This problem is avoided by updating the lower level weights annually. Consequently the results of the index will not be highly sensitive to the choices of categories.

The introduction of new weights provides an opportunity for changes to the index to be made. Most commonly, re-weighting can be used to introduce new goods and services into the index, but from time to time a more significant restructuring of the index may be necessary, for example, when a new classification of items may become necessary.

5.6.2. Sampling

With available computing power it is not necessary to sample. However, expenditure does tend to be highly concentrated, and using all items has the disadvantage of increasing the number of cases where transaction prices are not available in a time period.

This approach is particularly appealing in the context of sampling hospital accounts where the prices of high-cost events are likely to be volatile. It is proposed that the sampling of hospital accounts be based on both ICD-10 and CPT-4 codes, taking into account both the diagnosis and the procedure performed. It should be noted that price variation between accounts may still be significant, and ideally the sampling of hospital accounts should take into account case mix and severity. For example, claims could ideally be grouped using Diagnosis Related Groupings (DRGs). However, the methodology currently used to group hospital claims into homogeneous groups varies between schemes and hospital groups.

5.6.3. Obtaining price data

In order for a medical price index to be meaningful, transaction prices should be used. Whilst obtaining transaction prices may be complicated in certain environments (where, for example, transaction data are kept private for competitive reasons), medical scheme transaction prices are readily available in the form of claims data. Transaction prices will differ from list prices where medical schemes have entered into specific contractual arrangements with particular providers (as is the case with preferred provider networks), and where providers have the freedom to charge prices that differ from list prices (for example, in the case of Prescribed Minimum Benefits schemes have to reimburse the provider at the full price charged).

Medical scheme claims data will reflect more than one possible measure of price. There will be the price the provider charged (often referred to as the “account amount”), the price the medical scheme is willing to reimburse (often referred to as the “tariff amount”), and the price actually reimbursed by the scheme which may be affected by benefit limits and cost sharing with the medical scheme member (often referred to as the “paid amount”). The ideal price to use would be the tariff amount adjusted to reflect cost-sharing arrangements but not benefit limits. Where this is not possible the tariff amount is preferable to the paid amount.

List price data (reflecting the SEP) for pharmaceutical products are publicly available in the form of price files. The available price files provide a start date and end date for which a price is valid (i.e. prices are not published for particular dates). The account amount would reflect this list price (as providers are not allowed to charge more or less than the SEP), and may or may not include the dispensing fee. The definition of the tariff amount might also differ between medical scheme administrators. In combining data across administrators it would be necessary to establish

whether the tariff amount reflects any reference pricing and whether it includes the dispensing fee.

The notion of a list price does not exist for hospital claims as prices are negotiated between schemes (or administrators) and private hospital groups, and there is typically no “balance billing” (an amount billed in excess of the agreed tariff that is for the beneficiary’s account). For hospital claims it is suggested that an account re-pricing methodology be used. This method is used by Statistics South Africa (2009) and allows for shifts in methods of hospital remuneration over time. The account would cover the entire set of services provided during a patient visit, that is, ward fees, theatre fees and consumables.

One of the complexities arising from alternative reimbursement contracts is that there may be what is referred to as a “re-work difference” at the end of the contract period. This is an amount that is retrospectively determined based on claims experience over the period of the contract and does not relate to a particular account. Further analysis is required to assess the extent of these adjustments.

The list price for other practitioner types is the NHRPL. Individual schemes are encouraged to negotiate tariffs directly with practitioners, using the NHRPL as a guideline

One of the disadvantages of using transaction prices is that there may be breaks in the price series if there are months during which particular goods or services are not purchased. This problem will arise less frequently if prices are used only for a sample of goods and services, and the sampling methodology considers the frequency with which a product is claimed.

Where a price is temporarily missing for a product, the product can be omitted from the calculation of the index (ILO, *et al.*, 2004). However, this requires re-weighting other items in the same category. Alternatively a price change can be imputed based on the average price change for other products in the same category (ILO, *et al.*, 2004). The circularity of this solution is computationally inefficient. Other possible solutions include

excluding seasonal items from the basket or introducing the concept of a rolling year-on-year index (ILO, *et al.*, 2004). For medical goods and services where price changes are not volatile it is also possible to carry the last available price forward; this is the approach used in this research.

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Chapter 6

Results - an illustrative pharmaceutical price index

The methodology proposed in Chapter 5 is applied to pharmaceutical expenditure to create a price index for illustrative purposes. For the purposes of this illustration, data were obtained from Medscheme Pty (Ltd). Medscheme is an accredited medical scheme administrator and managed-care company, which in 2008 administered 16 medical schemes representing 12.4% of beneficiaries in the market (Council for Medical Schemes, 2009a).

The dataset contained pharmaceutical claims data for years 2006 through 2009. The transaction price (or tariff amount) for pharmaceutical products in this dataset is referred to as the Medscheme Price List (MPL). The MPL is a Medscheme-specific implementation of reference pricing, where the MPL is usually set at the cost of the second least expensive version of the medication in a therapeutic category. The beneficiary is not prevented from claiming for a more expensive drug, but the scheme will only reimburse the MPL price. The difference between the published list price (the SEP) and the MPL is paid by the beneficiary. Pharmaceutical product prices can be measured either including or excluding dispensing fees. The index was calculated on both bases for illustrative purposes.

The highly concentrated nature of pharmaceutical expenditure means that a high level of coverage can be achieved with a relatively small dataset. An analysis of 2008 data indicated that 15.46% of NAPPis (1534 products) accounted for 90% of expenditure on acute medication, and 5.39% of NAPPis (535 items) accounted for 90% of expenditure on chronic medication. However, no sampling was done as Medscheme had the computing power available to include all pharmaceutical products.

In order to calculate the elementary aggregates an average unit price had to be calculated for each product. This was calculated as an un-weighted average of the unit price for each pack size variation of that product. Each pack size has the same price per unit excluding dispensing fee, but the unit price including dispensing fee differs because the dispensing fee is calculated as a percentage of the total price of the pack.

Medscheme does not carry 9-digit NAPPI codes and the quality of the pack size data field was found to be questionable. The elementary aggregates thus had to be based on externally published list price information. The list price as at the 15th of each month was used. Using price data on a single date allows price data to be more easily checked, for example, on a particular date the SEP should be identical for all schemes. However, if the average price over a month is used, and the price changed during the course of the month, the average SEP is likely to differ between schemes (as the weight of transactions before and after the price change will differ). Where the price of a product was limited by MPL the price for the reference product was imputed.

As a result of not using transaction prices, the dispensing fee for each pack size had to be calculated using the relevant dispensing fee logic because dispensing fees differ by scheme, medicine schedule, whether the medicine was dispensed by a pharmacist or doctor and whether a designated service provider (DSP) was used or not. Examples of the dispensing fees for four schemes are given in Table 6.1. The published list price includes VAT, which has to be removed before calculating the dispensing fee.

Table 6.1 Examples of dispensing fees (November 2009)

Scheme	Pharmacy dispensed			Doctor dispensed		
	Schedule 0	Schedule <> 0	DSP	Schedule 0	Schedule <> 0	DSP
A	20%	26% to a max of R26		20%	30% to a max of R20 (incl VAT)	
B	20%	26% to a max of R26	20% to a max of R20	20%	30% to a max of R20 (incl VAT)	20% to a max of R20
C	36%	36%	20% to a max of R20 for chronic; else 26% to a max of R26	36%	30% to a max of R20 (incl VAT)	20% to a max of R20 for chronic; else 26% to a max of R26
D	26% not less than R15.00 (excl VAT)	26% not less than R15.00 (excl VAT)		36%	30% to a max of R20 (incl VAT)	

Source: Medscheme

Using published list prices also dealt with the problem of temporarily missing price information, where an item is not claimed in a particular month. Prices were imputed for discontinued products, using the last known price, for the remainder of the year until the basket was updated.

The expenditure shares were determined using the calculated average unit prices for each product multiplied with the quantities demanded of each product. In other words, the expenditure shares were not based on the actual expenditure on each product as this would have been skewed by changes in the mix of pack sizes dispensed over time.

The index reference period for the index was taken as January 2006. The price reference period was January of each year (in this case 2006 to 2009, inclusive). No allowance needed to be made for the claims to be fully run-off because the claim processing for pharmaceutical products is largely real-time. The prices were updated monthly, and the weights

updated annually. The weight reference period was the year preceding the price reference period.

The price indices calculated using the four possible measures of price (SEP excluding dispensing fee, SEP including dispensing fee, MPL excluding dispensing fee and MPL including dispensing fee) can be seen in Figure 6.1. The overall pattern of price changes is as expected; increases are concentrated in the months where the Department of Health published the maximum permitted increases to SEP. As expected, the MPL increases more slowly than the SEP; this is a feature of the MPL being benchmarked to the second cheapest drug in a category. The MPL is updated as drug prices change, so if the benchmark product increased in price so as to be more expensive than other products in the same category, the MPL would be updated to reflect a new benchmark.

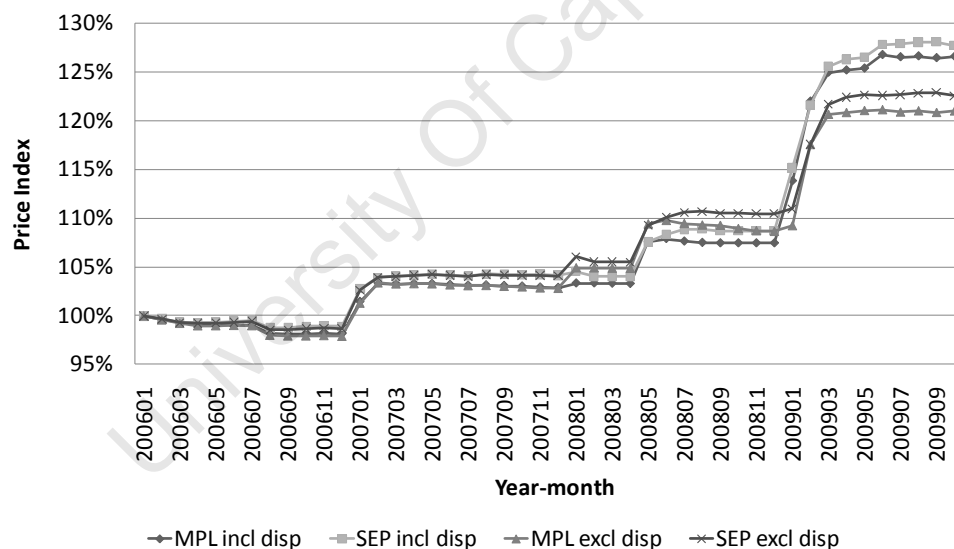


Figure 6.1 Pharmaceutical price indices reflecting alternative definitions of price

The weights for generic, original and branded products remained fairly stable over time, as illustrated in Figure 6.2.

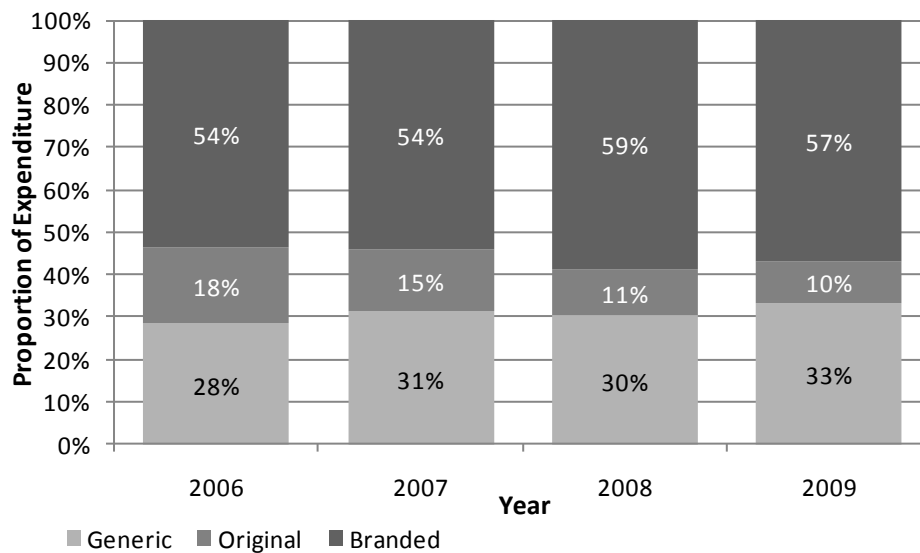


Figure 6.2 Expenditure shares for generic, original and branded products (2006-2009)

The expenditure shares were checked against Mediscor data (Mediscor, 2009) to assess the extent to which the Medscheme dataset is representative of the market. The comparison can be seen in Figure 6.3. It was found that generic use was slightly higher in each year in the Medscheme dataset. The use of branded and original products differed significantly with branded products having a greater representation in the Medscheme basket.

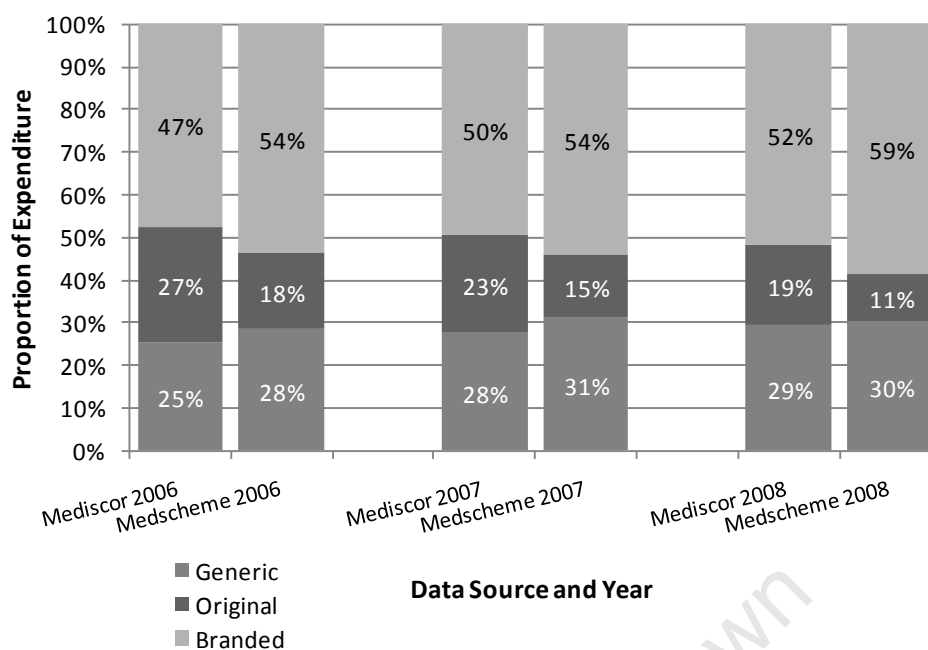


Figure 6.3 Comparison of expenditure shares for generic, original and branded products

From Figure 6.4 it can be seen that the extent of generic use varies significantly per benefit category, and the increases in the use of generics per category were substantial. However, a change in the mix of benefit categories over time resulted in a fairly muted overall increase.

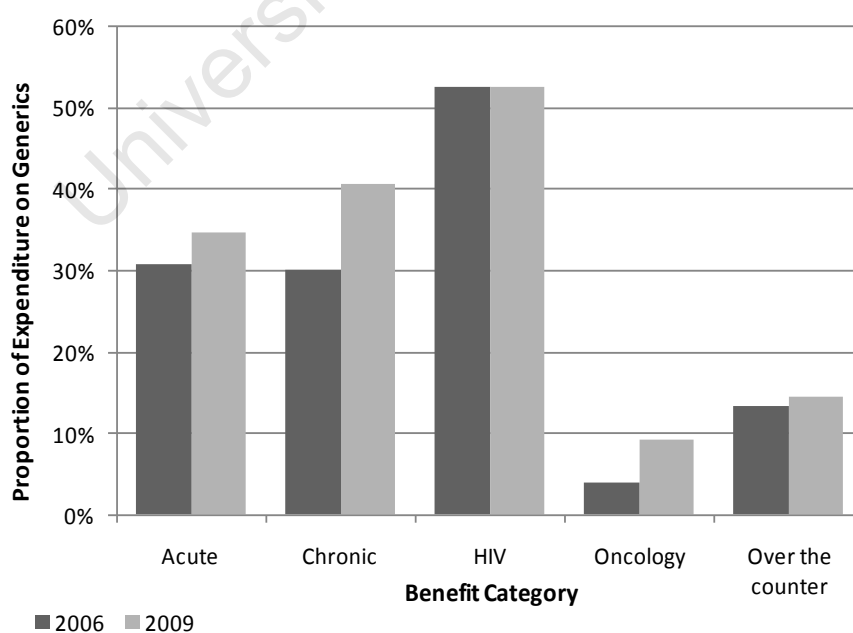


Figure 6.4 Expenditure shares for generic products per benefit category (2006 and 2009)

From the results for the generic, original and branded product sub-indices it is clear that the price development for these three categories of products is different (see Figure 6.5). Whilst the prices of generic products are lower, it was surprising to find that the prices of generics increased more rapidly than the prices of original and branded products. It is not surprising that the prices of original products rise the most slowly; these products have to compete with their generic equivalents (branded products still have patent protection).

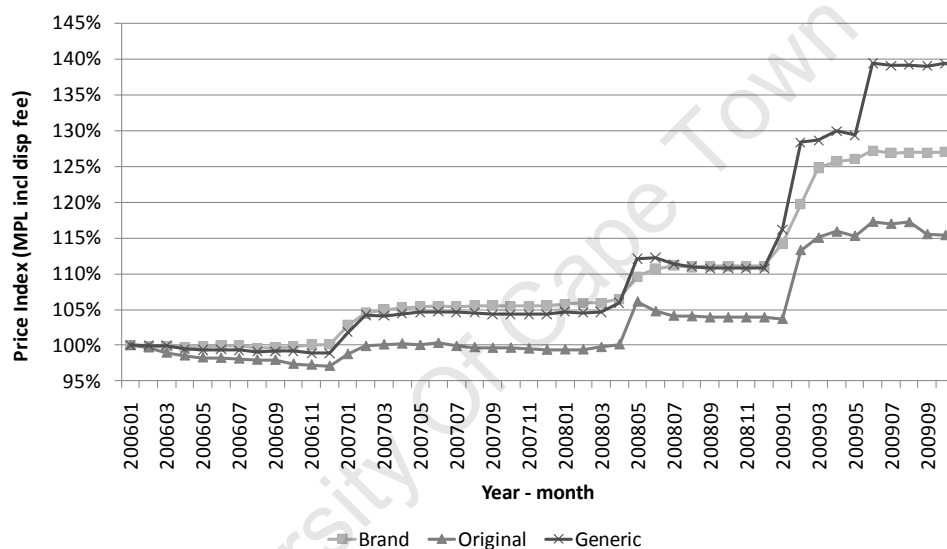


Figure 6.5 Pharmaceutical price indices for brand, original and generic pharmaceutical products

The results were checked against figures published by Mediscor (Mediscor, 2009). The Mediscor price index is based on changes in the SEP, excluding dispensing fees. The Mediscor price changes were found to be lower for all three categories; however the relationship between price changes for the three categories were found to be similar with original products increasing at a lower rate than generic and branded products. As discussed in section 2.9.2 the detail of the methodology used by Mediscor is not available and comparisons should be interpreted with caution.

As beneficiaries switch to generic products over time the expenditure weights will change to reflect a greater proportion of the expenditure share going to generic products. Consequently the index will reflect the change in the price of generic products to a greater extent. However, the overall index does not capture price differences between an original product and the generic version of that product and would thus overstate price changes.

The expenditure shares for each medicine schedule were found to change quite significantly over time. The proportion of expenditure on schedule 0 drugs doubled from 2006 to 2009. Comparable figures were not available in the Mediscor report and it was thus not possible to assess the extent to which the expenditure shares based on the Medscheme dataset are representative.

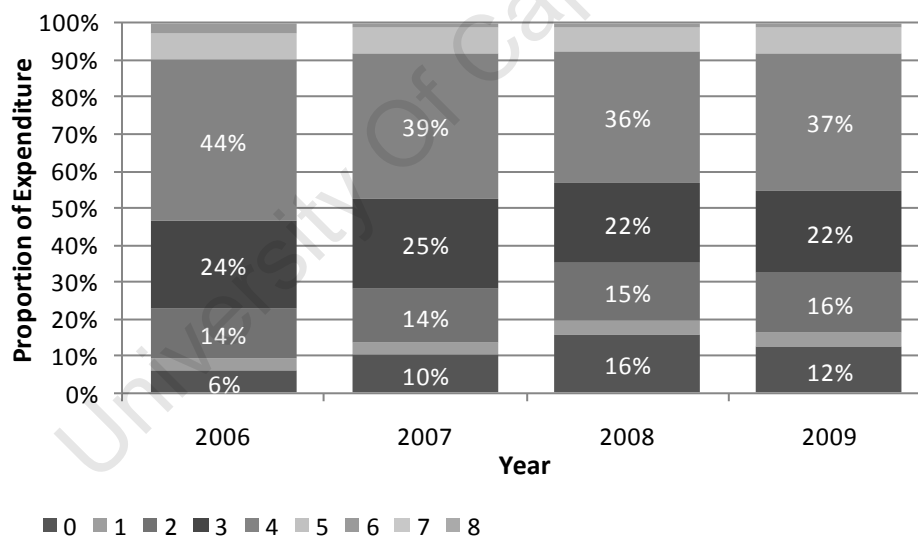


Figure 6.6 Expenditure share per medicine schedule (2006-2009)

The sub indices based on the medicine schedule appear to provide a useful basis for categorising pharmaceutical products. The results in Figure 6.7 indicate significant differences between schedules. In particular, schedule 0 drugs are not subject to the same price regulation as the other schedules, resulting in a different pattern of price changes over time. The

Mediscor results also reveal a significantly higher increase for schedule 0 drugs.

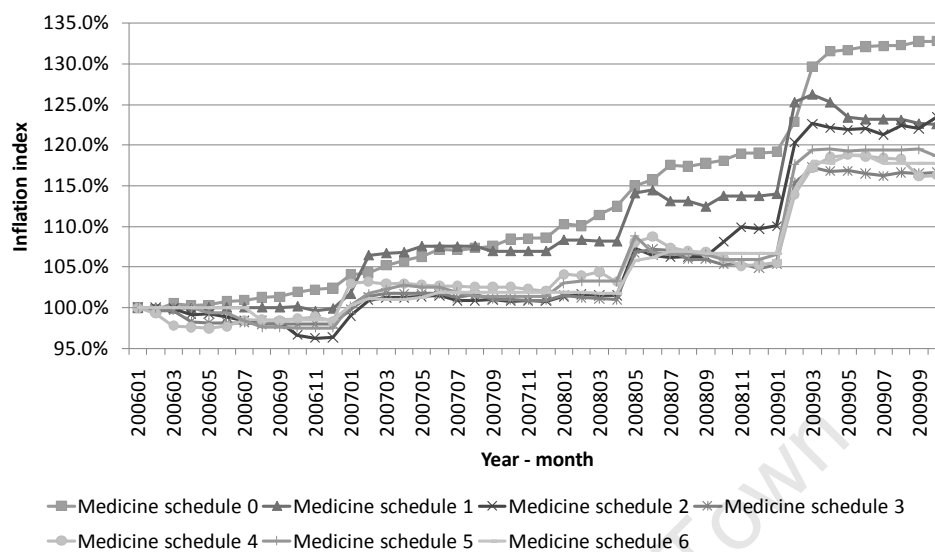


Figure 6.7 Pharmaceutical price indices per medicine schedule

Sub indices were also created for the different benefit categories (acute, chronic, over-the-counter, oncology and HIV). Schemes are likely to be interested in seeing the categories of expenditure separately because they differ in terms of financial importance, are subject to different levels of managed care intervention, and they are reported on separately in other contexts, for example, in managed care reports.

The expenditure shares for each of the categories can be seen in Figure 6.8. The shares were stable for the major categories (acute and chronic) but shifts in the other categories did occur over time. In particular, the proportion of expenditure going to over-the-counter medication increased from 7% in 2006 to 13% in 2009.

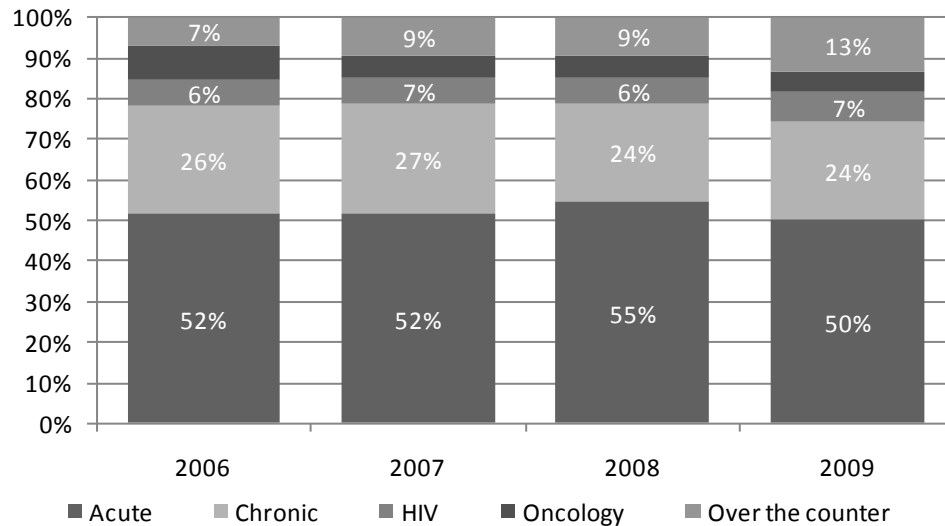


Figure 6.8 Expenditure shares per benefit category

The expenditure shares were checked against Mediscor data (Mediscor, 2009); the comparison can be seen in Figure 6.9. Given that benefit categorisation is based on the benefit design of the schemes in the dataset, comparability between schemes and administrators is anticipated to be low. As expected, the splits between benefit categories in the Medscheme dataset and the Mediscor data were found to be significantly different.

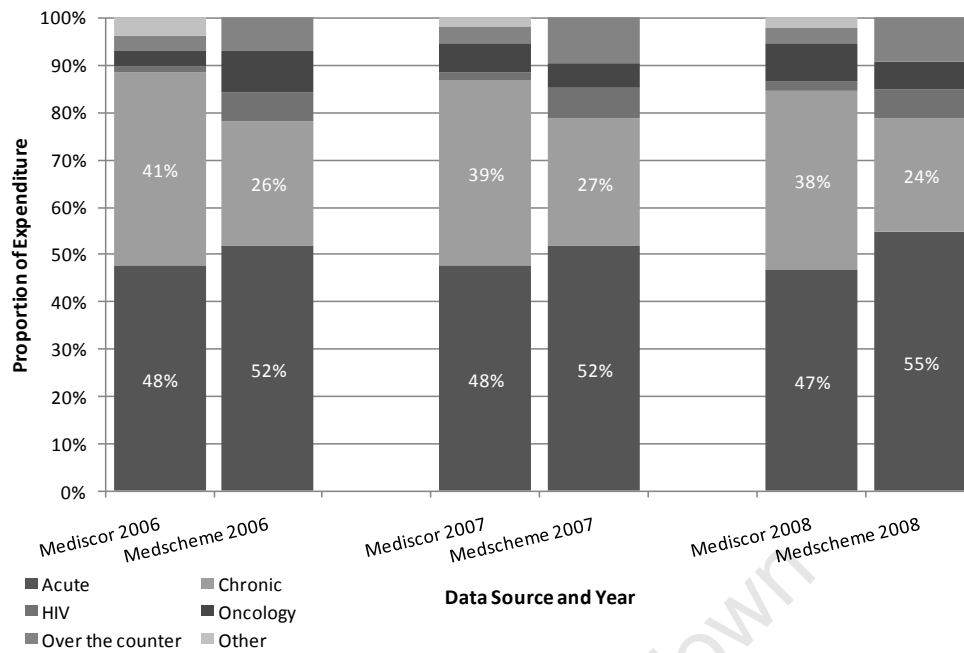


Figure 6.9 Comparison of expenditure shares for benefit categories

Despite the difficulties associated with using benefit categorisation, from the results in Figure 6.10 it can be seen that there are differences in price changes, particularly for HIV pharmaceuticals.

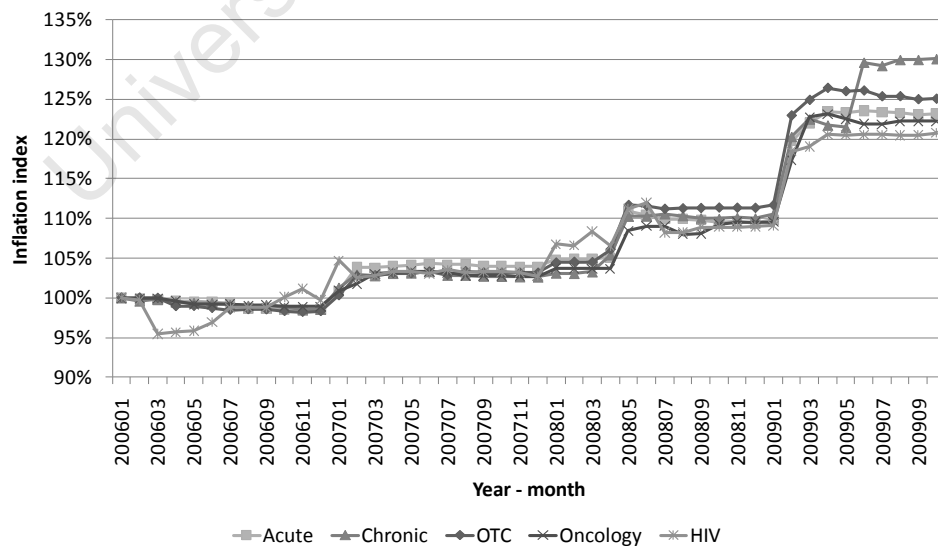


Figure 6.10 Pharmaceutical price indices per benefit category

Discussion and conclusions

The aim of this research was to propose a methodology for constructing a price index reflecting the experience of medical schemes in South Africa. The only other methodology, based on local private sector data, reflects the experience of medical scheme beneficiaries and not of medical schemes themselves (Da Silva, 2007). The work done is thus a first attempt to address the need for a medical scheme price index.

The advantage of looking at it from the perspective of beneficiaries is that a comparison with the medical component of the consumer price index is more meaningful. However, there are two disadvantages. The first is that by using medical scheme data, only a partial view of the beneficiary's experience of medical prices can be obtained. Out-of-pocket expenditure is only taken into account to the extent that claims are submitted, but not fully reimbursed. Out-of-pocket expenditure for medical scheme beneficiaries is significant and does vary extensively between categories of expenditure; consequently, the weights obtained for the various categories of expenditure can be expected to differ.

The second is that it is not clear who the key user of the index would be. Medical schemes themselves would presumably be more concerned with the prices they experience, and medical scheme beneficiaries would be concerned with their overall health expenditure, which can be viewed as being the sum of their medical scheme contributions and their out-of-pocket expenditure.

The proposed index is based on data collected from the six largest medical scheme administrators. Purposive sampling using administrators to provide clusters of medical scheme data increases the ease of data

collection and data cleaning, particularly since the data capturing and quality is likely to vary between administrators.

The proposed methodology needs to be tested on a more complete dataset. The methodology was only tested on pharmaceutical data, and this was based on data from one medical scheme administrator, namely Medscheme. The Medscheme data was checked against Mediscor (2009) data to ascertain whether it was representative. Deviations between the two data sources were observed and problems relating to differences in benefit category definitions were identified.

The work done by Da Silva (2007) was also based on data from a single administrator. Given that administrators (and managed care companies) impact on the prices experienced by their clients, for example, by negotiating with providers on their behalf, results are likely to be biased. In addition data quality is likely to vary by administrator, making the creation of a dataset that is more representative of the industry essential.

Unfortunately, the creation of an industry-wide dataset is a time-consuming and resource-intensive endeavour. As discussed in the introduction there are a number of potential uses for such an index, and it is suggested that the relevant stakeholders be approached to facilitate data collection. The regulator, in particular, should be enlisted to encourage scheme participation. A closer working relationship with Statistics South Africa is also likely to be fruitful given the increasing reliance on the private sector for price data and the significant methodological advances made by the agency in recent years.

It should be noted that medical scheme data are not likely, on their own, to be suitable for the purpose of constructing a consumer medical price index as medical schemes cover only 15.84% of the population (Council for Medical Schemes, 2009b; Statistics South Africa, 2008b) and the population covered by medical schemes is not representative of the population at large in a number of respects, *inter alia* income, age and geographical distribution (McLeod & Ramjee, 2007). By virtue of having access to medical cover, medical scheme beneficiaries are likely to make

use of more expensive medical goods and services. Lastly, the prices paid by medical scheme patients may differ from those paid by non-medical scheme patients.

The weighting structure proposed for a medical scheme index is hierarchical, with the weights for the top tiers of the basket (the split between medical and non-medical, and subsequently between major categories of expenditure such as hospital and pharmaceutical) updated every five years based on data in the Council annual reports.

Items are classified into the lower tiers according to a product-based classification system and it is suggested that the weights for these tiers be updated annually. All weights should be based on expenditure over a year to deal with seasonal effects on expenditure patterns. The index proposed by Da Silva (2007) used weights that were based on expenditure over a three-year period. Weights based on annual data have the advantage of more closely reflecting recent expenditure patterns. Weighting over a longer period will also tend to underweight new goods and services.

It is suggested that not all categories of items and practitioners be included in the index to simplify the computation. However, the advantage of a sector-focussed index, as opposed to an economy-wide index like CPI, is that a larger set of items can be covered. The sample size of items to include in the index would depend on the computational power available for compiling the index and the sampling methodology would be proportional (based on expenditure) with very high-cost, low-frequency items being excluded. The work done on creating a pharmaceutical index revealed that expenditure on pharmaceutical products is highly concentrated.

A Dutot index is proposed for calculating the elementary aggregates, and a Young index at the higher levels of aggregation. Statistics South Africa (2009) uses a Young index, whilst Da Silva (2007) describes the index used as a chained-linked Laspeyres. The index would be published monthly and chain-linked when weights are updated. It is proposed that

the index be calculated separately for open schemes, restricted membership schemes and the industry as a whole.

Where possible, transaction prices should be used to increase the accuracy of the index. For pharmaceutical prices list price data are required to calculate accurately unit prices, as was illustrated in Chapter 6. The Da Silva (2007) index used prices per pack and not unit prices; the disadvantage of this approach is that the index will reflect changes in the mix of pack sizes sold and not just changes in the unit price. Using the example of a pack of Panados: if the price per Panado remains unchanged but purchasing patterns change (so that people switch from packs of 20 Panados to packs of 30 Panados) the index will reflect a price increase where none has occurred.

The medical scheme price data can also be supplemented by data from providers. For example, it is proposed that hospital prices be based on a sample of accounts obtained directly from the major hospital groups. Statistics South Africa (Kelly, 2009) uses a similar methodology. Whilst there are some technical difficulties associated with re-pricing accounts, the method is an effective means of allowing for changes in reimbursement methods over time, as well as providing some allowance for changes in technology.

The proposed methodology goes some of the way to addressing the commonly-arising biases in price indices. Price indices based on historical weights are exposed to the risk of substitution bias. Substitution bias is unlikely to be of major concern in the medical scheme context given that medical scheme beneficiaries tend to have low levels of price sensitivity due to agency problems, information asymmetry and third-party-payer effects. There are some areas of expenditure where medical schemes are able to strongly influence purchasing decisions (for example, by using reference pricing and formularies for pharmaceutical products), and in these areas of expenditure there is the possibility of a historically weighted price index being biased upward. Further work is required to determine the elasticity of substitution for medical schemes.

To the extent that substitution bias does exist, the proposed updating of weights annually reduces the bias. The decision to update weights annually is supported by the results in Chapter 6 where it can be seen that expenditure shares do change from year to year.

A Young index formula (based on historical expenditure share weights) was proposed to deal with the seasonal effects in medical scheme expenditure as it allows for both weights based on annual data and the timeous publication of the index.

The availability of medical scheme claims data obviates the need for outlet sampling to obtain price data. Transaction prices can be determined directly from the claims data, and these prices would reflect the actual mix of providers utilised in each category. This eliminates any potential for outlet substitution bias, which would arise if the index did not reflect the price savings incurred as a result of medical scheme beneficiaries switching to lower-cost providers. Such switching may occur if, for example, a medical scheme implemented a preferred-provider network.

Consumer price indices are susceptible to new product bias because weights are updated infrequently. This is particularly problematic in a sector which experiences rapid technological change such as the health care sector. This is addressed in the proposed methodology by updating weights on an annual basis, allowing new products to be incorporated into the index more frequently. The index can be improved by introducing a mechanism for capturing price changes between original drugs and generics. If new products are introduced that do not fall neatly into the proposed index categories the weighting structure of the index will need to be changed.

Bias arising from quality changes has not been addressed at all, largely because the interplay between medical care, health and utility is exceedingly complex. This presents a significant opportunity for further research.

Considerable further work needs to be done in order to refine and test the methodology. The proposed methodology also needs to be tested for

the other sub-indices, in particular to assess whether the proposed units of service, elementary aggregation and hierarchical structures are optimal.

Episode groupers are still in their infancy in the South African medical scheme market. Given that they provide a clinically meaningful unit of analysis it is anticipated that their use will become more widespread in future. The use of episodes of care will enhance the accuracy of a price index by allowing for changes in technology and quality, thus the methodology should be adapted as the use of episode groupers becomes standardised. The testing of alternative methodological choices (for example, the choice of formula) on a more complete dataset is likely to yield interesting insights.

Comparing results for different medical schemes will provide insights into the effects of rationing on price increases over time, and the extent to which managed care organisations are effective at managing price. The basket of goods and services purchased will differ between schemes. The effect of the basket on price change can be computed by calculating the index based on industry weights and on individual scheme weights.

Particular areas were neglected in the proposed methodology and thus require further work. As already mentioned, the extent of changes in quality was not considered. In addition, work needs to be done on developing an appropriate method for grouping hospital claims. Such research can be done in conjunction with the private hospital groups who, in the process of implementing alternative reimbursement arrangements, have engaged with this issue already.

A deeper understanding of how medical scheme beneficiaries respond to price changes, and whether price substitution and outlet substitution do occur would serve to further understanding of the likely extent of bias in the index.

The proposed methodology can be extended to consider the price changes experienced by medical scheme beneficiaries. This would build on the work done by Da Silva (2007) to include out-of-pocket expenditure for people with medical scheme cover. Medical scheme data can be used to

determine transaction prices (using the account amount) but data would have to be collected to determine the expenditure weights for out-of-pocket expenditure.

The creation of a medical scheme contribution index would be of interest to the regulator and would allow an exploration of the differences between prices experienced by medical schemes and the price to consumers of medical scheme cover. This extension would also be of interest to Statistics South Africa as they include the price of medical scheme cover in the Consumer Price Index.

The results for the pharmaceutical price index are pleasing in that they reflect the expected price dynamics over the period. The relationships between the different categories of products are as expected. Ideally the results should be compared to other available figures but this is not possible either because it is not clear what the methodological differences are (as with the Mediscor and Medikredit indices) or because the methodological differences are too great for a comparison to be meaningful (as with the Statistics South Africa index and the Da Silva index).

This research has revealed an under-explored area of work and opens up numerous avenues for further investigation. In addition, the medical sector is innovative and will continue to evolve rapidly and the proposed index methodology will need to respond to these changes.

It is hoped that the potential uses of such an index are evident and that both medical scheme administrators and the regulator are motivated to collaborate on establishing a more comprehensive dataset to enable further research to take place.

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Appendix A

Given the number of terms involved the formulation the computational equations are presented structurally summarised. The first tier is presented in full, while only a single term has been expanded for tiers two, three and four. The full formulation involves the expansion of each of the terms as outlined in Table A.1 in a similar way. The table also provides the proportion of expenditure for the time period 2008.

Tier One

$$I_t = \frac{p_m^t}{p_m^0} \times s_m^{bb} + \frac{p_n^t}{p_n^0} \times s_n^{bb}$$

where:

$$s_m^{bb} = \frac{p_m^b q_m^b}{p_m^b q_m^b + p_n^b q_n^b}$$

$$s_n^{bb} = \frac{p_n^b q_n^b}{p_m^b q_m^b + p_n^b q_n^b}$$

p_m^t is the price of the medical goods and services basket at time t

p_n^t is the price of the non-medical goods and services basket at time t

q_m^t is the quantity of medical goods and services consumed at time t

q_n^t is the quantity of non-medical goods and services consumed at time t

Tier Two

$$\frac{p_m^t}{p_m^0} = \frac{p_h^t}{p_h^0} \times s_h^{bb} + \frac{p_s^t}{p_s^0} \times s_s^{bb} + \frac{p_p^t}{p_p^0} \times s_p^{bb} + \frac{p_g^t}{p_g^0} \times s_g^{bb} + \frac{p_d^t}{p_d^0} \times s_d^{bb} + \frac{p_o^t}{p_o^0} \times s_o^{bb}$$

where:

$$s_x^{bb} = \frac{p_x^b q_x^b}{p_h^b q_h^b + p_s^b q_s^b + p_p^b q_p^b + p_g^b q_g^b + p_d^b q_d^b + p_o^b q_o^b}$$

p_x^t is the price of the basket of a particular category of tier-two medical goods and services at time t

q_x^t is the quantity of a particular category of tier-two medical goods and services consumed at t

x denotes the particular category of tier-two medical goods and services under consideration, where x takes on the value of one of the following:

h denotes hospital goods and services

s denotes medical specialist goods and services

p denotes pharmaceutical goods and services

g denotes general practitioner goods and services

d denotes dental goods and services

o denotes other goods and services

Tier Three

$$\frac{p_h^t}{p_h^0} = \frac{p_{lh}^t}{p_{lh}^0} \times s_{lh}^{bb} + \frac{p_{mc}^t}{p_{mc}^0} \times s_{mc}^{bb} + \frac{p_{nc}^t}{p_{nc}^0} \times s_{nc}^{bb}$$

where:

$$s_y^{bb} = \frac{p_y^b q_y^b}{p_{lh}^b q_{lh}^b + p_{mc}^b q_{mc}^b + p_{nc}^b q_{nc}^b}$$

p_y^t is the price of the basket of a particular category of tier-three medical goods and services at time t

q_y^t is the quantity of a particular category of tier-three medical goods and services consumed at time t

y denotes the particular category of tier-three medical goods and services under consideration, where y takes on the value of one of the following:

lh denotes Life Healthcare

mc denotes Medi-Clinic

nc denotes Netcare

Tier Four

$$\frac{p_{lh}^t}{p_{lh}^0} = \frac{p_{day}^t}{p_{day}^0} \times s_{day}^{bb} + \frac{p_{med}^t}{p_{med}^0} \times s_{med}^{bb} + \frac{p_{surg}^t}{p_{surg}^0} \times s_{surg}^{bb} + \frac{p_{mat}^t}{p_{mat}^0} \times s_{mat}^{bb}$$

where:

$$s_z^{bb} = \frac{p_z^b q_z^b}{p_{day}^b q_{day}^b + p_{med}^b q_{med}^b + p_{surg}^b q_{surg}^b + p_{mat}^b q_{mat}^b}$$

p_z^t is the price of the basket of a particular category of tier-four medical goods and services at time t

q_z^t is the quantity of a particular category of tier-four medical goods and services consumed at time t

z denotes the particular category of tier-four medical goods and services under consideration, where z takes on the value of one of the following:

day denotes day cases

med denotes in-patient medical cases

$surg$ denotes in-patient surgical cases

mat denotes in-patient maternity cases

Table A.1 Expenditure weights based on 2008 industry data

Tier One	Tier One Expenditure Weights	Tier Two	Tier Two Expenditure Weights	Tier Three	Tier Three Expenditure Weights	Coverage
Medical	85.7%	Hospital	40.9%	Life Healthcare	34.7%	74.7%
				Medi-Clinic	30.5%	
				Netcare	26.4%	
					100.0%	
		Medical Specialist	21.9%	Pathologist	22.0%	84.9%
				Radiologist	22.0%	
				Anaesthetist	10.8%	
				Physician	6.5%	
				Orthopaedic surgeon	6.5%	
				Otorhinolaryngologist	6.5%	
				Surgeon	5.9%	
				Gynaecologist	5.4%	
				Ophthalmologist	4.8%	
				Paediatrician	4.3%	
				Cardiology	2.7%	
				Psychiatrist	2.7%	
					100.0%	
		Pharmaceutical	15.6%			88.5%
		General Practitioner	7.4%			100.0%
		Dental	2.8%			78.6%
		Other	11.4%	Optometrist	27.6%	50.9%

				Pharmacist	19.0%	
				Physiotherapist	19.0%	
				Medical technologist	19.0%	
				Radiotherapist	15.5%	
					100.0%	
			100.0%			
Non-medical	14.30%	Administration fee	69.2%	Discovery	34.9%	76.80%
				Medscheme	16.1%	
				Metropolitan Health	28.4%	
				Old Mutual Healthcare	8.1%	
				Momentum	5.7%	
				Full Circle Health	3.5%	
				Sechaba	3.3%	
					100.0%	
		Managed care fee	17.5%			100.0%
		Acquisition	11.9%			100.0%
		Other	1.4%			0.0%
			100.0%			
TOTAL	100.0%					
OVERALL COVERAGE						79.0%